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Inhalt des 47. Bandes

Verzeichnis der neuen Taxa im 47. Band

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On three species of *Periscyphis* Gerstaecker, 1873 from Kenya, Sudan and Oman (Crustacea: Isopoda: Oniscidea)

Stefano Taiti, Franco Ferrara & Andreas Allspach

Abstract. *Periscyphis brunneus* Budde-Lund, 1912 from Kenya is redescribed on the basis of the type-material and new material examined, and the lectotype is designated. Two new species, *P. sudanensis* from Sudan and *P. albomarginatus* from Oman, are described. All species presently included in *Periscyphis* are listed with their distributions.
Key words. Crustacea, Isopoda, Oniscidea, Eubelidae, *Periscyphis*, new species, Kenya, Sudan, Oman.

The genus *Periscyphis* Gerstaecker, 1873 belongs to the family Eubelidae which represents the most important fraction of the Oniscidean fauna of tropical Africa and the Arabian Peninsula. The genus is characterized by the pereonite 1 with the posterior corners entire (i.e. without a schisma) and no ventral lobes or teeth, antennal flagellum of two articles, inner branch of the maxillule with two penicils, exopods of pleopods 1 and 2 with monospiracular covered lungs. All species of *Periscyphis* populate arid or semiarid areas.

After Omer-Cooper's (1926) comprehensive revision, many new species have been ascribed to *Periscyphis* (Arcangeli 1929; 1934; 1940; Barnard 1940; 1941; Ferrara 1972; 1973; 1974; Schmölzer 1974; Ferrara & Taiti 1982; 1986; 1988; 1996; Taiti & Ferrara 1989; 1991; Erhard & Schmalfuss in press) so that to date the genus has included with certainty 36 species distributed in northeastern Africa, Israel and the Arabian Peninsula.

In this contribution one poorly-known species, *Periscyphis brunneus* Budde-Lund, 1912 from Kenya, is redescribed and two new species from Sudan and Oman are described, bringing the number of species in the genus to 38 (Table 1).

Abbreviations: MZUF — Museo Zoologico "La Specola" dell'Università, Firenze; NRM — Naturhistoriska Riksmuseet, Stockholm; ONHM — Oman Natural History Museum, Muscat; SMF — Senckenberg-Museum, Frankfurt/Main.

Periscyphis brunneus Budde-Lund, 1912, Figs 1, 2

Periscyphis brunnea Budde-Lund, 1912 (in Lönnberg & Budde-Lund, 1912): 7, Fig. 5.
Periscyphis brunneus; Omer-Cooper, 1926: 398; Paulian de Félice, 1945: 342; Ferrara & Taiti, 1979: 135.

Lectotype (here designated): ♀, Kenya, Njoro, N of Guaso Nyiri river about 1 °N lat., under the sheaths of palm leaf-stalks, leg. E. Lönnberg, 17. II. 1911, NRM 2648.
Paralectotype: 1 ♀, same data as lectotype.
Material examined: 4 ♂♂, 2 ♀♀, Kenya, Kora National Reserve, 00°02'S—38°37'E, leg. R. C. Davis, 2. II. 1984, MZUF 1579.

Redescription: Maximum dimensions: ♂, 6 x 2.5 mm; ♀, 6.5 x 2.8 mm. Brown with the usual pale muscle spots; uropods pale (red in vivo?). Dorsum smooth with inconspicuous

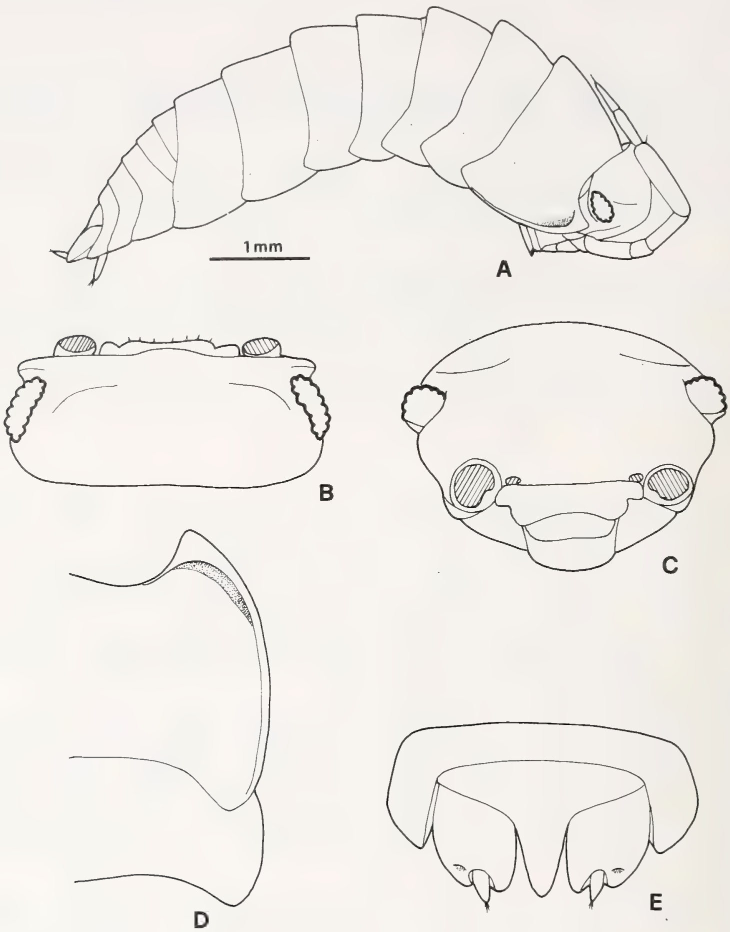

Fig. 1: *Periscyphis brunneus* Budde-Lund, 1912, ♂ from Kora National Reserve: A, adult specimen, lateral view; B, cephalon, dorsal view; C, cephalon, frontal view; D, right side of pereonites 1 and 2, dorsal view; E, pleonite 5, telson and uropods.

pointed scale-spines. Eye with about 25 ommatidia. Cephalon with broadly rounded lateral lobes; no frontal margin; interocular line visible only at sides; profrons slightly bulbous in the middle. Pereonite 1 with lateral margin slightly thickened; a shallow sulcus arcuatus only in the anterior third; posterior corners rounded, distinctly protruding backwards. Pereonites 2—7 with posterior corners progressively less protruding backwards. Telson with distal part narrow, triangular with narrowly rounded apex. Antenna short, reaching rear margin of pereonite 2 when pushed back; flagellar articles subequal in length. Uropodal protopod with convex outer margin and posterior margin indented, a small glandular area near postero-lateral corner; small exopod distinctly protruding backwards.

Male: Pereopods 1—3 carpus with a brush of pointed spines. Pereopod 7 without special modifications; ischium with straight sternal margin. Pleopod 1 exopod with quadrangular medial part, distal margin with a row of strong spines; endopod with a thickset distal part

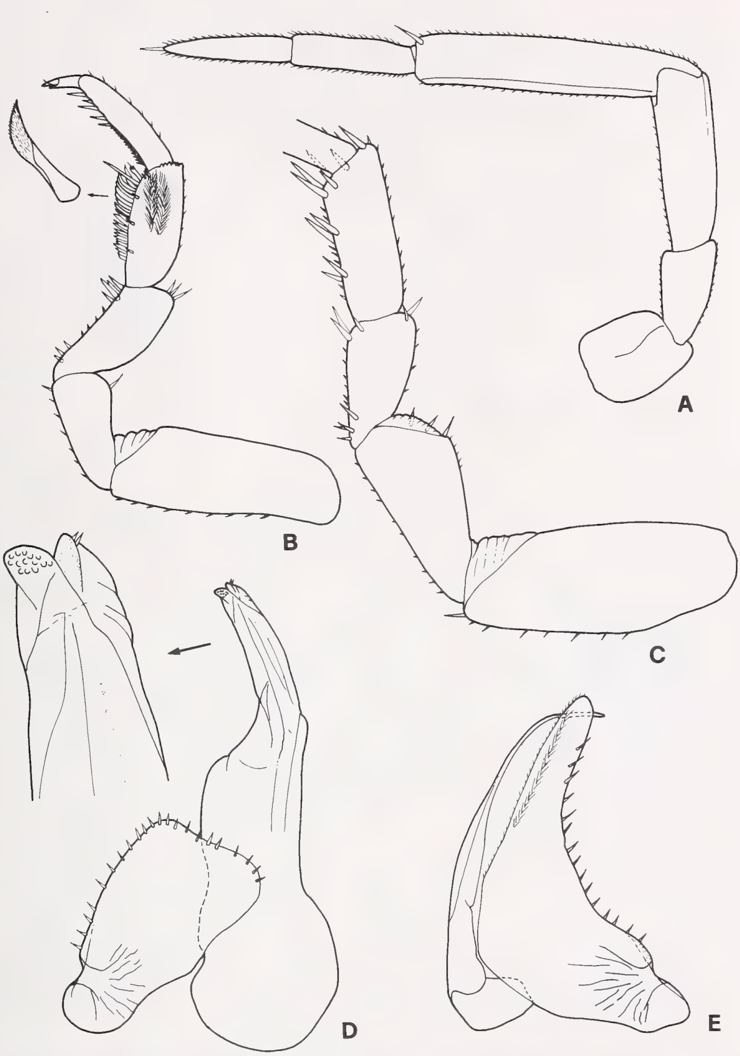

Fig. 2: *Periscyphis brunneus* Budde-Lund, 1912, ♂ from Kora National Reserve: A, antenna; B, pereopod 1; C, pereopod 7; D, pleopod 1; E, pleopod 2.

and bilobed apex, outer lobe with some small rounded scales, inner lobe triangular with two spines. Pleopod 2 as in Fig. 2E.

Remarks: Since no illustrations, except for the apex of the maxilliped, were provided by Budde-Lund (1912) in the description of *Periscyphis brunneus*, this species is redescribed here and its diagnostic characters are illustrated. It is characterized by the cephalon with no frontal line and distinct interocular line on the vertex, the pereonite 1 with the lateral margin slightly thickened and the sulcus arcuatus present only in the anterior third, and by the male pleopod 1 endopod with a bilobed apex. The colour pattern (brown with pale uropods) is also a useful distinguishing character.

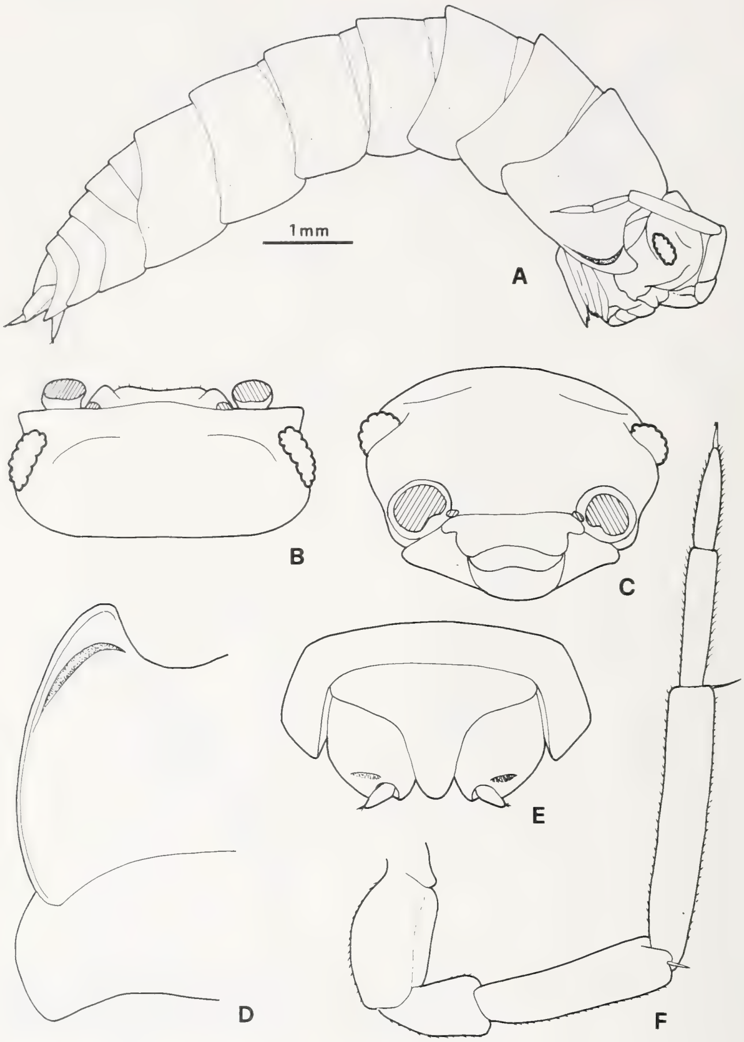

Fig. 3: *Periscyphis sudanensis* n. sp., ♀ from Erkowit: A, adult specimen, lateral view. ♂ from Erkowit: B, cephalon, dorsal view; C, cephalon, frontal view; D, left side of pereonites 1 and 2, dorsal view; E, pleonite 5, telson and uropods; F, antenna.

Periscyphis sudanensis n. sp., Figs 3, 4

Periscyphis trivialis; Vandel 1964: 735, Fig. 1II.

Holotype: ♂, Sudan, village Erkowit at Mount Erkowit, ca. 50 km SW of Suakin, 1200 m, leg. A. Allspach, 2. III. 1987, SMF 22681.
Paratypes: 2 ♂♂, 1 ♀, 2 juvs, same data as holotype, SMF 22682; 1 ♂, 1 ♀, same data, MZUF 4778.
Additional material examined: 3 ♂♂, 4 ♀♀, Sudan, Sanganeb Island, N of Port Sudan, at lighthouse, leg. V. Neumann, 31. III. 1991, SMF 22683; 1 ♂, 1 ♀, same data, MZUF 4779.

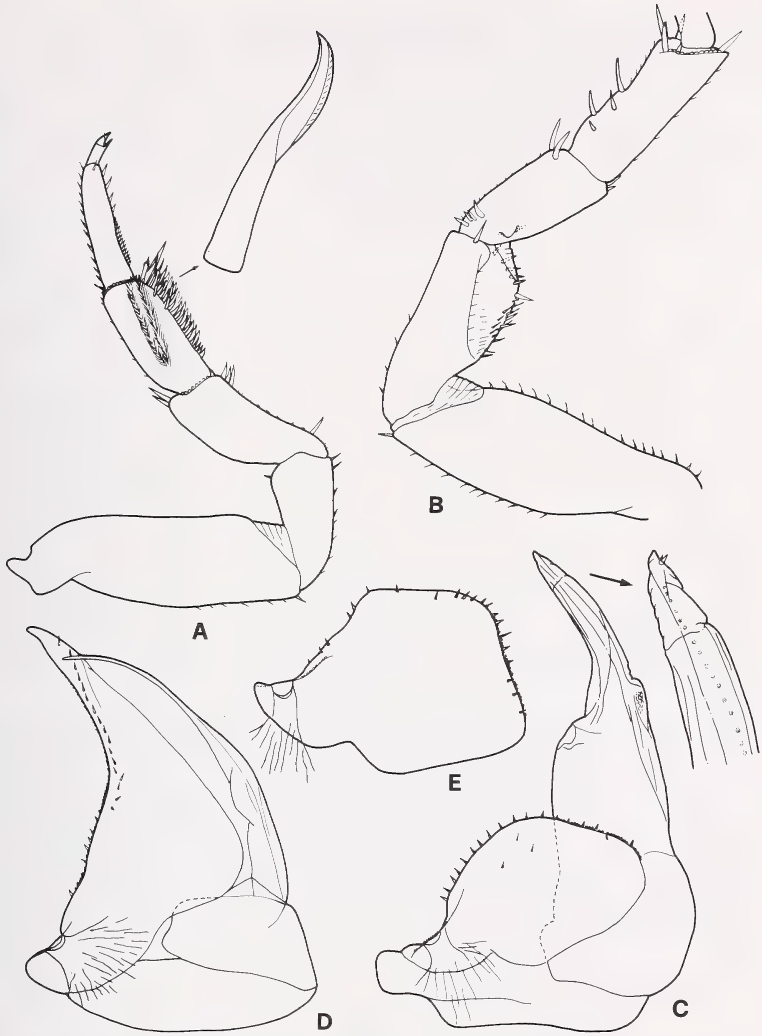

Fig. 4: *Periscyphis sudanensis* n. sp., ♂ from Erkowit: A, pereopod 1; B, pereopod 7; C, pleopod 1; D, pleopod 2. ♂ from Sanganeb Is.: E, pleopod 1 exopod.

Description: Maximum dimensions: ♂, 8 x 3.2 mm; ♀, 9 x 3.5 mm. Light brown with posterior margin of pereonites, pleon and telson darker; epimera of pereonites and pleonites and uropods pale. Dorsum smooth with inconspicuous pointed scale-spines. Eye with about 21 ommatidia. Cephalon similar to the preceding species, i. e. with broadly rounded lateral lobes, no frontal margin, interocular line visible only at sides and profrons slightly bulbous in the middle. Pereonite 1 with lateral margin slightly thickened; a shallow sulcus arcuatus only in the anterior third; posterior corners rounded, protruding backwards. Pereonites 2—7 with posterior corners slightly protruding backwards. Telson with distal part triangular and rounded apex, reaching tips of uropodal protopods. Antenna reaching middle of pereonite 2

when pushed back; first flagellar article almost 3/2 as long as second. Uropodal protopod large, with convex outer margin, a large indentation on posterior margin and a wide transverse glandular area near postero-lateral corner; small exopod distinctly protruding backwards.

Male: Pereopods 1—3 carpus with a brush of recurved and pointed spines. Pereopods 2—4 ischium and merus with some small verrucae on sternal margin. Pereopod 7 ischium with a large depression on distal rostral surface, sternal margin almost straight; merus proximally with a small rounded tubercle near tergal margin and a group of four spines near sternal margin. Pleopod 1 exopod subtriangular, with broadly rounded posterior margin equipped with short spines; endopod with distal part pointed and bent outward. In specimens from Sanganeb Island the pleopod 1 exopod is subtrapezoidal (cf. Fig. 4E). Pleopod 2 as in Fig. 4D.

Etymology: The name refers to Sudan where the specimens were collected.

Remarks: In the structure of the cephalon (without frontal margin) and pereonite 1 (with the sulcus arcuatus present only in the anterior third of the segment) *Periscyphis sudanensis* is similar to *P. cavernicolus, P. abyssinicus, P. jannonei, P. verhoeffi, P. somaliensis* and *P. brunneus*. It is readily distinguished from all these species by the male pereopod 7 merus with a distinct tubercle on the rostral surface and a basal group of spines near the sternal margin, and by the different shape of the telson. Moreover, it differs from *P. abyssinicus* and *P. jannonei* in the absence of a rectangular protrusion on the sternal margin of the male pereopod 7 ischium; from *P. verhoeffi* in the absence of a large lamellar lobe on the tergal margin of the male pereopod 7 merus; from *P. brunneus, P. cavernicolus* and *P. somaliensis* in the different shape of the apex of the male pleopod 1 endopod.

In the presence of a meral tubercle on the male pereopod 7, *P. sudanensis* corresponds to *P. vittatus* and *P. insularis*. It is easily distinguished from the former by the presence of the sulcus arcuatus (absent in *P. vittatus*) on pereonite 1 and the telson reaching the posterior margin of the uropodal protopod (it is distinctly shorter in *P. vittatus*) and from the latter essentially by the structure of the telson and uropods (compare Fig. 3E and Fig. 14 in Ferrara & Taiti 1989).

In the specimens from Sanganeb Is. the male pleopod 1 exopod is morphologically different from that of the specimens from Erkowit (compare Fig. 4C and Fig. 4E), while all the other characters correspond. With the material at our disposal we are not able to say whether this difference is within the intraspecific variability or, instead, it is indicative of distinct taxa. For the time being, we prefer to include the specimens from Sanganeb Is. in the new species without considering them as paratypes. Vandel (1964: 735) recorded *P. trivialis* from Suakin, Sudan. However, from his illustration of the male pleopod 1 exopod, it is clear that the specimens examined by Vandel do not belong to *P. trivialis* but to *P. sudanensis*, having affinity particularly with the specimens from Sanganeb Is. (compare Fig. 1II in Vandel 1964 and Fig. 4E).

Periscyphis albomarginatus n. sp., Figs 5, 6

Holotype: ♂, Oman, Masirah Island, near S tip, 20°12'N—58°40'E, 1100 m, under shrub on mountain side, leg. M. D. Gallagher, 5. VI. 1991, ONHM.
Paratype: ♂, same data as holotype, MZUF 4780.

Description: Maximum dimensions: 14 x 8 mm. Grey-brown with posterior part of cephalon, epimera of pereon and pleon, tip of telson and uropods pale; pereonites with a large pale spot in the middle and two pale paramedian spots in correspondence to the muscle insertions. Dorsum smooth with inconspicuous pointed scale-spines. Eye with 23—24 ommatidia. Cephalon with broadly rounded lateral lobes; frontal margin interrupted in the middle; interocular line reaching middle of the eyes; profrons bulbous in the middle. Pereonite 1 with a conspicuous lateral thickening and a deep narrow sulcus arcuatus in the anterior half; posterior margin slightly concave at sides; posterior corners broadly rounded. Telson with distal part triangular and rounded apex, slightly surpassing tips of uropods. Antenna long with first flagellar article almost twice as long as first. Uropodal protopod subquadrangular with posterior margin indented and small glandular area near exopod insertion; exopods minute. Pereopods 1—3 with a brush of recurved pointed spines on carpus and, progressively

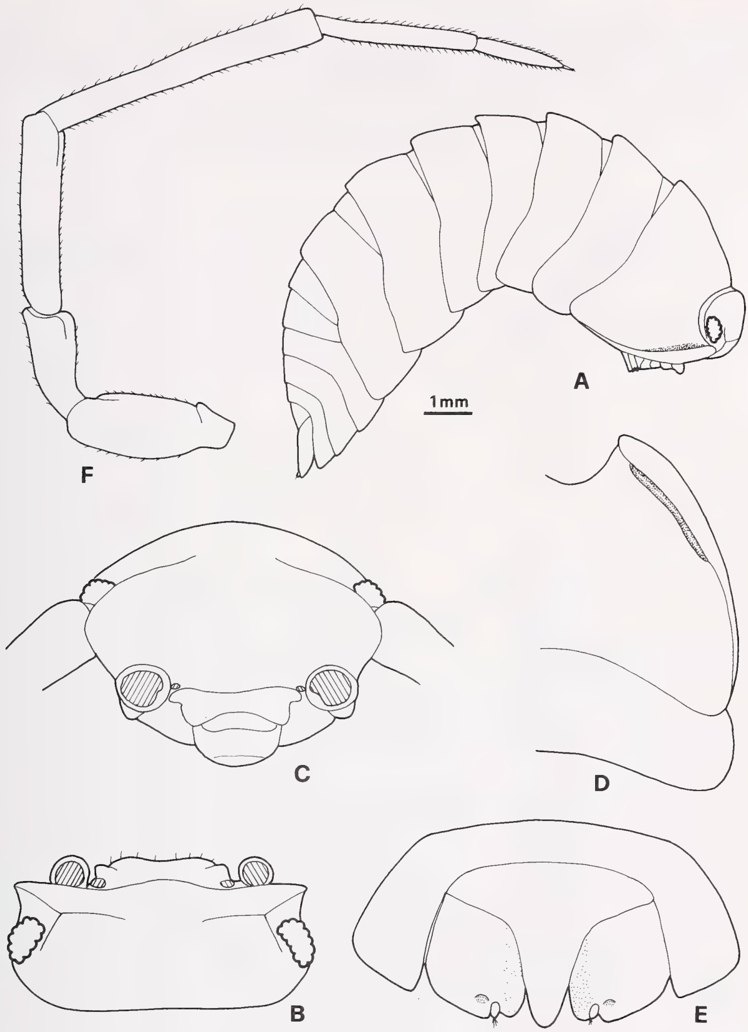

Fig. 5: *Periscyphis albomarginatus* n. sp., ♂: A, adult specimen, lateral view; B, cephalon, dorsal view; C, cephalon, frontal view; D, right side of pereonites 1 and 2, dorsal view; E, pleonite 5, telson and uropods; F, antenna.

more reduced, on merus. Pereopods 1—4 ischium and merus with some small verrucae on sternal margin. Pereopod 7 ischium with concave sternal margin and distally with a large depression on rostral surface; carpus flattened, recurved and slightly enlarged, with a distal lobe on caudal surface equipped with three strong spines. Pleopod 1 exopod with rounded distal margin; endopod with pointed apex slightly bent outwards. Pleopod 2 as in Fig. 6D.

Etymology: L. albus = white + marginatus = having a margin. The name refers to the characteristic colour pattern (in alcohol) with a large pale stripe all around the body.

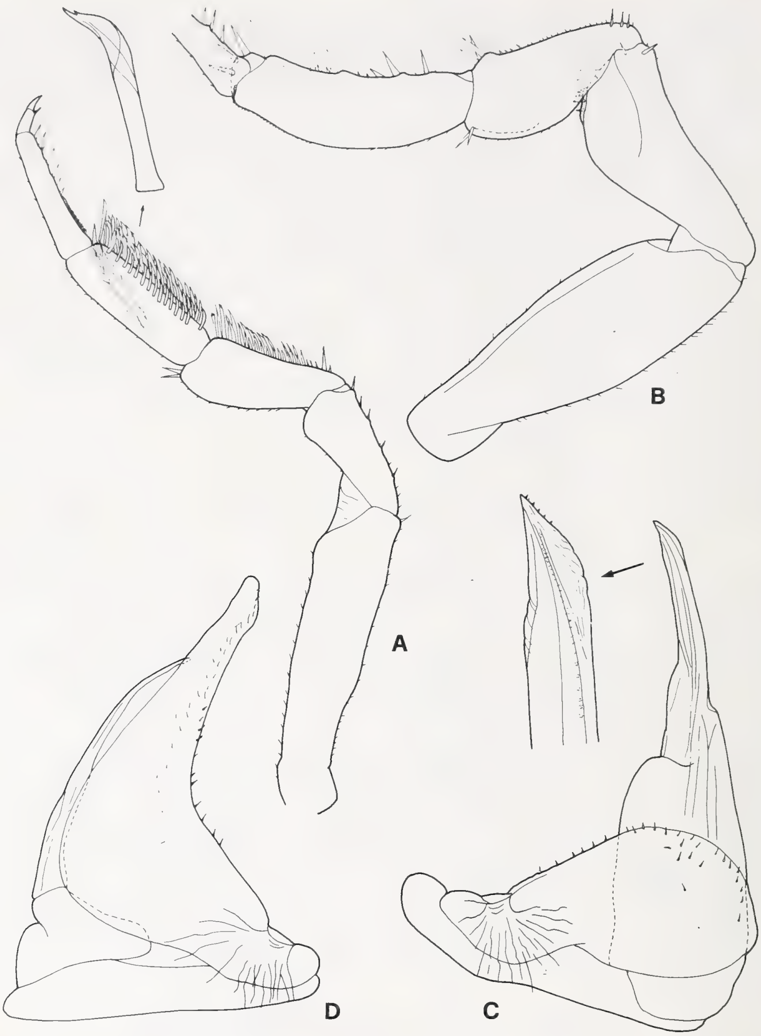

Fig. 6: *Periscyphis albomarginatus* n. sp., ♂: A, pereopod 1; B, pereopod 7; C, pleopod 1; D, pleopod 2.

Remarks: The new species belongs to the *granai*-group, characterized by the cephalon with large rounded lateral lobes which continue in a frontal margin, entire or interrupted in the middle, large quadrangular uropodal protopod, and male pereopod 7 with sexual modifications on the ischium and carpus. This group includes *P. granai, P. latissimus, P. arabicus, P. barnardi, P. omanensis, P. buettikeri, P. insularis* and *P. minor.* In the frontal margin interrupted in the middle, *P. albomarginatus* corresponds to *P. buettikeri* and *P. insularis* (all the other species in the group have a continuous frontal margin) and it is readily distinguished from both by the telson with rounded, instead of acute, apex surpassing the posterior margin

of the uropodal protopod. It also differs from *P. buettikeri* in the sulcus arcuatus anteriorly not bent inwards, the regularly convex lateral margin of pereonite 1 (it has a distinct depression in *P. buettikeri*) and the carpus of the male pereopod 7 with the tergal margin much less convex; and from *P. insularis* in the lack of a tubercle on the merus of the male pereopod 7.

Table 1: *Periscyphis* species* and their distributions.

1)	*Periscyphis abyssinicus* Ferrara, 1972	Ethiopia
2)	*Periscyphis albescens* (Budde-Lund, 1885)	Egypt and Sudan
3)	*Periscyphis albomarginatus* n. sp.	Oman
4)	*Periscyphis albus* Erhard & Schmalfuss, in press	Israel and Egypt
5)	*Periscyphis arabicus* Barnard, 1941	Saudi Arabia and Yemen
6)	*Periscyphis barnardi* Ferrara & Taiti, 1986	Yemen
7)	*Periscyphis besi* Barnard, 1941	Yemen
8)	*Periscyphis brunneus* Budde-Lund, 1912	Kenya
9)	*Periscyphis buettikeri* Ferrara & Taiti, 1986	Saudi Arabia
10)	*Periscyphis cavernicolus* Omer-Cooper, 1926	Ethiopia
11)	*Periscyphis civilis* Budde-Lund, 1908	Somalia and Kenya
12)	*Periscyphis convexus* (Budde-Lund, 1885)	Egypt, Sudan, Djibouti and Tanzania (?)
13)	*Periscyphis felix* Taiti & Ferrara, 1989	Saudi Arabia
14)	*Periscyphis granai* Arcangeli, 1929	Eritrea
15)	*Periscyphis insularis* Ferrara & Taiti, 1988	Oman
16)	*Periscyphis jannonei* Arcangeli, 1940	Sudan and Ethiopia
17)	*Periscyphis lanzai* Ferrara, 1973	Somalia
18)	*Periscyphis latissimus* Omer-Cooper, 1926	Eritrea
19)	*Periscyphis laticarpus* Taiti & Ferrara, 1989	Saudi Arabia and Kuwait
20)	*Periscyphis libycus* Arcangeli, 1934	Libya
21)	*Periscyphis limbatus* Omer-Cooper, 1926	Kenya
22)	*Periscyphis merolobatus* Ferrara & Taiti, 1982	Eritrea
23)	*Periscyphis minor* Ferrara & Taiti, 1996	Yemen
24)	*Periscyphis nigricans* Omer-Cooper, 1926	Ethiopia
25)	*Periscyphis omanensis* Taiti & Ferrara, 1991	Oman
26)	*Periscyphis pulcher* Budde-Lund, 1898	Tanzania
27)	*Periscyphis rubroantennatus* Ferrara, 1974	Somalia
28)	*Periscyphis ruficauda* Budde-Lund, 1908	Somalia and Kenya
29)	*Periscyphis somaliensis* Ferrara, 1973	Somalia
30)	*Periscyphis strouhali* Arcangeli, 1929	Eritrea
31)	*Periscyphis subtransversus* Omer-Cooper, 1926	Egypt (?)
32)	*Periscyphis sudanensis* n. sp.	Sudan
33)	*Periscyphis trivialis* Gerstaecker, 1873	Ethiopia, Somalia, Kenya and Tanzania
34)	*Periscyphis tschadensis* Schmölzer, 1974	Chad
35)	*Periscyphis undulatus* Omer-Cooper, 1926	Ethiopia
36)	*Periscyphis vandeli* Ferrara, 1973	Somalia
37)	*Periscyphis verhoeffi* Arcangeli, 1929	Ethiopia and Kenya
38)	*Periscyphis vittatus* Omer-Cooper, 1926	Saudi Arabia, United Arab Emirates, Oman, Yemen, Eritrea, Djibouti, Somalia and Mozambique

* Four species described in *Periscyphis* (*P. kalongensis* Arcangeli, 1950 from Zaire, *P. montanus* Schmölzer, 1974, *P. pallidus* Schmölzer, 1974 from Kenya, and *P. niger* Schmölzer, 1974 from Tanzania) certainly do not belong to this genus.

Acknowledgements

We wish to express our sincerest thanks to Dr. L. Sandberg (NRM) for the loan of the type-specimens of *Periscyphis brunneus*, to Dr. M. D. Gallagher (ONHM) who entrusted us with the specimens of the new species *P. albomarginatus*, and to Dr. V. Neumann (SMF) who collected specimens of the new species *P. sudanensis* during his marine biological stay at Sanganeb Is., Sudan.

Zusammenfassung

Periscyphis brunneus Budde-Lund, 1912 von Kenia wird auf der Basis des Typenmaterials und neuer Exemplare aus Kenia wiederbeschrieben und der Lectotypus bestimmt. Zwei neue Arten, *P. sudanensis* aus Sudan und *P. albomarginatus* aus Oman, werden beschrieben. Die bis heute bekannten Arten der Gattung *Periscyphis* werden mit ihrer Verbreitung tabellarisch zusammengestellt.

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Coccinellidae (Coleoptera) aus Rwanda

Helmut Fürsch

Abstract. Coccinellids from Rwanda, collected by Thomas Wagner by fogging rainforest trees with pyrethrum, are listed and the following new species are described and figured: *Afidenta muehlei*, *Boschalis wagneri*, *Epilachna carapacola*, *Epilachna conspergata*, *Nephus brevipilosus*, *Nephus rugulipennis*, *Ortalia gracilis*, *Pseudoscymnus brunneus*, *Scotoscymnus glabripilosus*, *Scotoscymnus maximus*, *Scymnus rwandensis*, *Telsimia striata*. New synonyms: *Scymnus luniferus* Sicard is a younger synonym of *Scymnus usambaricus* Weise and *Scymnus* (*Nephus*) *circumcinctus* Mader of *Nephus* (*Sidis*) *burgeoni* Mader.

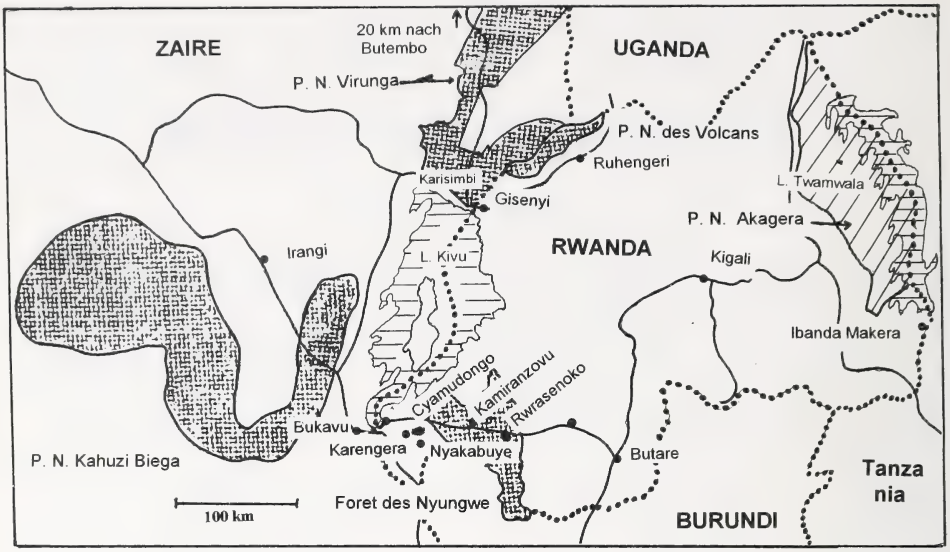
Key words. Coccinellidae, Africa, Rwanda, taxonomy, ecology, collecting methods.

Einleitung

Thomas Wagner erforschte im Oktober 1993 im Rahmen seiner Dissertation über Biodiversität in tropischen Waldökosystemen die Arthropodenfauna Rwandas und des benachbarten Ost-Zaire. Dabei wandte er neben Hand- und Kescherfängen eine neue Methode an: Er benebelte für die entsprechenden Phytozönosen dominierende Bäume mit einem Nebelgerät 'Swingfog SN-50' und 1%iger Pyrethrumsuspension. Die ausgewählten Bäume waren nicht höher als 8 m, da vom Boden aus gearbeitet wurde und höhere Bäume nicht vollständig benebelt werden konnten. Mit dieser Methode wurden jeweils mehrere Bäume behandelt und die herunterfallenden Arthropoden in Trichtern aufgefangen. Damit war es erstmals möglich, den Arthropodenbestand eines Baumes vollständig zu erfassen. Die Nummern der Einzelbäume sind hinter dem Artnamen der gefundenen Coccinelliden vermerkt. Wagners Vorgehensweise erbrachte eine einzigartige Zahl neuer Arten, wie das seit den ersten Zeiten der Erforschung der Coccinellidenfauna nicht mehr der Fall war. Zur Abrundung wurden hier auch Sammelergebnisse von Hans Mühle aus Nyakabuye mitbearbeitet.

Material und Methoden

Das Material von Thomas Wagner, zusammen mit den Aufsammlungen von Hans Mühle (Fürsch 1991) bieten eine Gesamtübersicht der Coccinellidae Rwandas unter Berücksichtigung der Arbeiten Maders (1941, 1950 und 1954) über die Exploration du Parc National Albert (heute Parc National des Virunga in Zaire und Parc National des Volcans in Rwanda) mit Ergänzungen von Fürsch (1991). In diesem Zusammenhang sei auch auf Nummelin & Fürsch (1992) verwiesen. Das Material befindet sich im Museum Koenig Bonn (ZFMK) sowie in der Sammlung Fürsch (CF in ZSM). Vergleichsmaterial stammt auch aus dem Zoologischen Museum der Humboldt-Universität Berlin (MHB), dem Institut Royal des Sciences Naturelles, Bruxelle (IRSN), dem Zoolog. Museum Helsinki (ZMH), dem British Museum of Natural History, London (BMNH), dem Museum Georg Frey, München (MGF), der Zoologischen Staatssammlung München (ZSM), dem Musée National d'Histoire Naturelle, Paris, sowie dem Musée Royal de l' Afrique Centrale, Tervuren (MRAC).



Karte der Fundgebiete. Schraffiert: Trockenwaldsavanne; gerastert: Regen- und Nebelwaldgebiete (im Parc National des Virunga (ehemals Parc National Albert) sind große Savannengebiete enthalten). Gezeichnet nach verschiedenen Vorlagen, vor allem von Th. Wagner.

Alle Genitalorgane sind nach Mikropräparaten in Hoyers Gemisch mit Zeichenapparat in vergleichbaren Maßstäben skizziert. Die beigegebene Karte soll einen Überblick über die Lage der Fundorte geben.

Ergebnisse

Der besondere Wert der Ausbeute Wagners liegt nicht nur in der für heutige Zeiten ungewöhnlichen Zahl neuer Arten, sondern in der Zuordnungsmöglichkeit zu bestimmten Ökotypen. Zunächst werden die Coccinelliden der verschiedenen Waldtypen aufgelistet und dann die neuen Arten beschrieben. Ziffern hinter dem Artnamen bedeuten Nummer des untersuchten Baumes. Wo diese fehlt, bezieht sich die Angabe auf Kescher- oder Handfang in dieser Phytozönose.

1. Trockenwald, südl. des Parc National de l' Akagera bei Ibanda Makera.
   Baumart: *Lannea fulva* (Anacardiaceae).

Boschalis wagneri Fürsch 4
Exochomus troberti concavus Fürsch 1, 2
Nephus castaneicolor Sicard 1
Nephus rugulipennis sp. n.
Ortalia argillacea Mulsant 1, 2, 3, 4
Ortalia gracilis sp. n.
Ortalia pallens Mulsant 1
Platynaspis capicola Crotch
Platynaspis kollari Mulsant
Scymnus (*Pullus*) *rwandensis* sp. n. 4
Scymnus (*Pullus*) *usambaricus* Weise 4

Scymnus levaillanti Mulsant
Scymnus nummelini Fürsch 4
Scymnus pruinosus Weise 4

2. Galeriewald südl. des Parc National de l' Akagera bei Ibanda Makera.
   Baumart *Teclea nobilis* (Rutaceae).

Chilocorus distigma Klug 10
Declivitata amoenula (Gerstäcker) 1, 3, 8
Nephus castaneicolor Sicard 5
Nephus microglobosus Fürsch 8
Nephus rugulipennis sp. n.
Scymnus (*Pullus*) *rwandensis* sp. n. 3, 4, 5, 6, 8, 9
Scymnus (*Pullus*) *thiollierei didymus* Sicard 3, 10
Scymnus kibonotensis Weise 7
Scymnus levaillanti Mulsant 1, 3, 5, 6, 7, 8, 9 10
Scymnus nummelini Fürsch 6, 7
Scymnus pruinosus Weise 5, 6, 9
Telsimia inornata Casey 6

3. Nebelwald Forèt de Nyungwe und Cyamudongo. Baumart *Carapa grandiflora* (Meliaceae).

Aulis korschefskyi Mader 3, 12
Bambusicola centralis (Sicard) 1 (bei Karengera)
Boschalis striata sp. n. 17
Boschalis wagneri Fürsch 1, 9, 11, 12, 17
Cheilomenes aurora (Gerstäcker)
Chnootriba similis Thunberg 2 (bei Kamiranzovu)
Epilachna aestimabilis (Mader) 3
Epilachna carapacola sp. n. 3, 17
Epilachna conspergata sp. n. 1, 2, (bei Kamiranzovu)
Epilachna karisimbica (Weise)
Epilachna korschefskyi (Mader)
Epilachna loveni (Weise) 1
Epilachna novemdecemguttata (Weise) 1
Epilachna paradoxa (Mader)
Epilachna tenelloides Fürsch 1 (bei Karengera)
Epilachna zuluensis Crotch
Exochomus troberti concavus Fürsch 2 (bei Kamiranzovu)
Henosepilachna annulata (Kolbe) (bei Karengera)
Henosepilachna biplagiata (Kolbe)
Henosepilachna humerosa (Weise) 13
Henosepilachna kaesebergi (Weise)
Henosepilachna lucifera (Arrow)
Lotis neglecta Mulsant 2 (bei Kamiranzovu)
Nephus brevipilosus sp. n. 1, 9, 12
Nephus circumcinctus (Mader) 2 (bei Kamiranzovu)
Pseudoscymnus brunneus sp. n. 4, 7, 11, 12
Scotoscymnus glabripilosus sp. n. 1, 2, 4, 7, 9, 12, 17
Scotoscymnus maximus sp. n. 3, 4, 9, 11, 12, 17
Scymnus (*Pullus*) *severus* Weise 2
Scymnus (*Pullus*) *thiollierei didymus* Sicard 11
Scymnus (*Pullus*) *usambaricus* Weise 1, 3, 4, 7, 9, 11, 12, 17
Scymnus kibonotensis Weise
Scymnus nummelini Fürsch
Telsimia striata sp. n. 3, 4

Forèt de Nyungwe bei Rwrasenkoko. Baumart *Hagenia abyssinica* (Rosaceae).

Scymnus levaillanti Mulsant 2

weiterhin:
Chnootriba neglecta Mader auf *Alchemilla ellenbeckii*
Lioadalia sexareata Weise auf *Alchemilla ellenbeckii*

4. Karisimbi 3000 m, auf *Senecio johnstonii.*
Epilachna gyldenstolpei (Weise)
Lioadalia sexareata Weise

5. Oberer Tieflandregenwald, Forschungsstation Irangi in Ost-Zaire.
Cheilomenes aurora (Gerstäcker)
Declivitata inclusa Mulsant
Epilachna aestimabilis (Mader)
Epilachna boops Fürsch (bei Kahuzi Tschiranga)
Epilachna kaestneri conjugata Fürsch
Epilachna nigromarginata Fürsch (bei Kahuzi Tschiranga)
Epilachna tenelloides Fürsch
Epilachna tredecimpunctata (Mader)
Henosepilachna mutata fulvicollis Fürsch
Scymnus (*Pullus*) *thiollierei didymus* Sicard, auf *Carapa grandiflora* 11, 51
Stethorus weisei Mader, Mt. Ilimu, 1700 m, auf *Carapa grandiflora* 11

6. Bemerkenswerte und neue Arten

Scymnus* (*Pullus*) *rwandensis sp. n. (Abb. 1-8, 106)

Diagnose: Rundlich, hochgewölbt, gelb, Elytren ringsum geschwärzt, am breitesten an der Basis. Länge: 1.6—1.8 mm; Breite: 1.1—1.3 mm.

Beschreibung: Kopf gelb, fein genetzt und mit Punkten von der Größe der Augenfacetten. Die weißen Haare sind nach der Mitte gerichtet. Pronotum etwas dunkler gelb, auf glattem Untergrund Punkte, die etwas kleiner sind als die Augenfacetten. Ziemlich dicht gelbweiß behaart, hinter den Augen wirbelig, sonst halbaufrecht nach hinten (elytrenwärts) gerichtet. Pronotum verbreitert sich nach hinten und ist nur knapp vor der Basis etwas eingeengt. Scutellum schwarz. Elytren in der Mitte gelb, sonst schwarz gerahmt, Elytrenhinterrand gelb wie Abb. 106. Hinter der Mitte am breitesten. Oberfläche fein genetzt und grob punktiert. Schulterbeule deutlich. Die Elytrenwölbung fällt zum Seitenrand sehr steil, fast senkrecht ab. Seitenrandung nur an der Schulter deutlich. Elytrenbehaarung wie auf Pronotum nach hinten gerichtet.

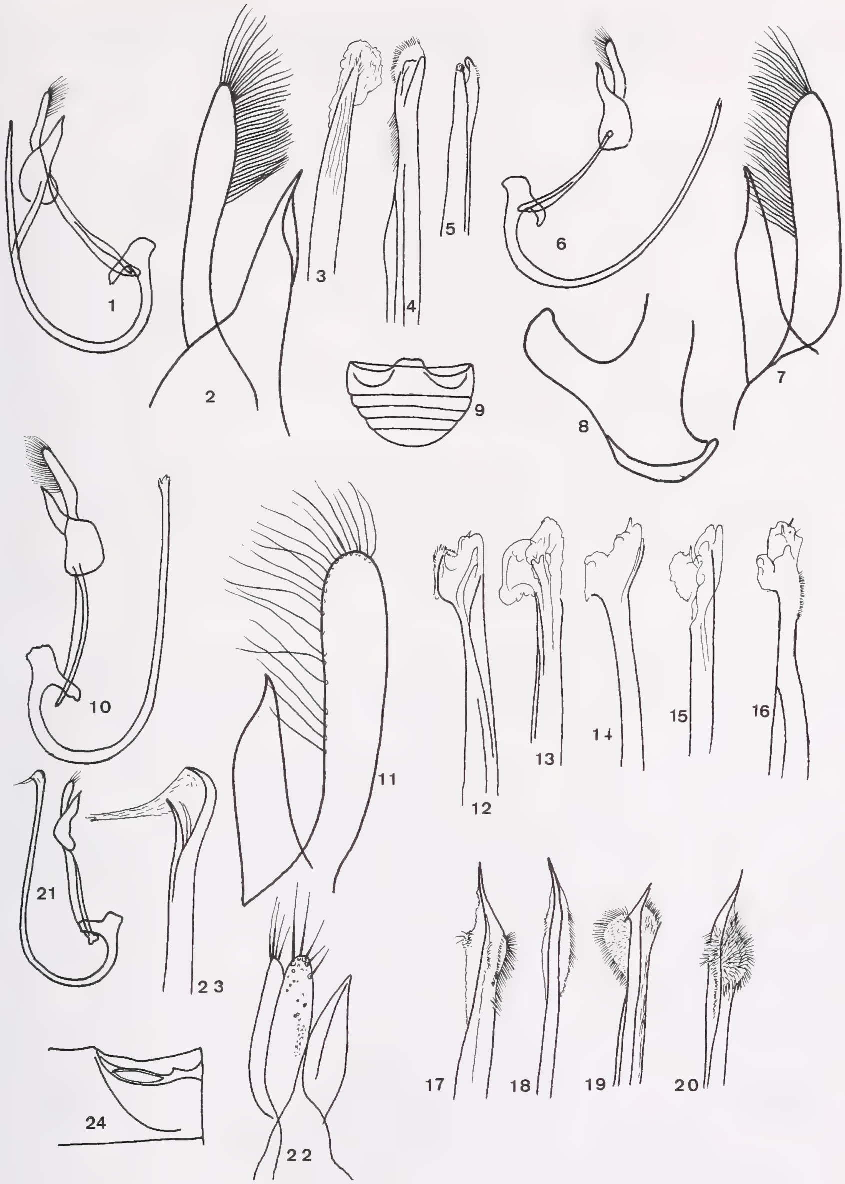
Differentialdiagnose: *Scymnus alluaudi* Sicard zum Verwechseln ähnlich, dieser ist auf den Elytren noch etwas deutlicher punktiert. Auf fast glatter Oberfläche stehen die sehr großen Punkte etwa einen Punktdurchmesser voneinander getrennt. Bei *S. rwandensis* ist die Punktierung „unruhiger", rugulöser. Einzig sicheres Unterscheidungsmerkmal: Die Siphospitze (Abb. 3,4). Sie ist bei *S. rwandensis* meist doppelt, während sie bei *S. alluaudi* in einer dünnen Spitze endet und davor ein „Stachelpolster" aufweist (Abb. 17—20). Dieses sieht man zuweilen auch bei *S. rwandensis*, doch fehlt hier die fein ausgezogene Spitze. Ähnlich ist auch *S. usambaricus* Weise, doch ist diese Art meist einfarbig braungelb.

Material: Holotypus, männl. Rwanda: Rusumo, Ibanda Makera 10. 1993 auf *Teclea nobilis*, leg. Th. Wagner. 7 Paratypen mit den gleichen Daten (ZFMK, 2 CF). Weiteres Material: Uganda, W. Prov. Kibale Forest, sweep K 14 5. 1. 1984 leg. N. Nummelin (ZMH, CF).

Scymnus* (*Pullus*) *usambaricus Weise (Abb. 10-16)

Scymnus (*Pullus*) *usambaricus* Weise, 1897 Dt. ent. Z.: 301. Fürsch 1966: 176.
Scymnus (*Pullus*) *luniferus* Sicard, 1931: 229, Syn. nov.

Untersuchtes Material: Lectotypus und Paralectotypen von *S. usambaricus* aus Kwai (MHB), Lectotypus von *S. luniferus*, männl. aus den Usambara Mts. bei Amani 20. 2. 1926, "taken by beating coffee foliage" coll. A. H. Ritchie. 2 Paralectotypen mit den gleichen Daten



Tafel 1: 1—8: *Scymnus rwandensis* sp. n.: 1—3 Holotypus: 1 Holotypus (b); 2 Tegmen (c); 3 Siphospitze (c); 4 Siphospitze, Kibale Forest (c). 5—9 Paratypen: 8 Siphonalbasis (c); 9 Abdomen (a). — 10—16: *Scymnus usambaricus*: 10—12 Cyamodungo; 13 Bulengwa; 14, 15 Paratypen; Lectotypus von *S. luniferus*. — 17—20: *Scymnus alluaudi*, Siphospitzen: 17 Gargaro Tana; 18 Kamerun, Nkolentangan; 19 Tanzania, Duluti; 20 id. Usa River. — 21—24 *Nephus rugulipennis* sp. nov. Holotypus: 24 linke Hälfte des 1. Abdominalsternits mit Femorallinie (a). — a—c = Maßstäbe wie auf Tafel 4 unter Abb. 77: a = 1 mm; b, c, = 0,1 mm. Alle Detailabbildungen sind in diesen Maßstäben gezeichnet. Die dargestellten Details sind in der Legende nicht aufgeführt, wenn sie vorher schon erläutert worden sind, um die Übersichtlichkeit zu erhöhen und Wiederholungen zu vermeiden.

(Festlegung hiermit) (BMNH). Beide Arten unterscheiden sich weder im Habitus noch am Aedeagus voneinander. Kwai liegt bei Amani. Zahlreichen Belege aus Rwanda leg. Th. Wagner (siehe Liste) (ZFMK), Kenya, Tanzania (MHB, ZSM, CF).

Nephus* (*Sidis*) *rugulipennis sp. n. (Abb. 21-24, 107)

Etymologie: lat. rugula = kleine Runzel; penna = Flügel(decken).

Diagnose: Langoval, schwarz, nur Kopf (männl.), Mundwerkzeuge, Beine und ein Fleck in der hinteren Hälfte der Elytren gelbrot (Abb. 107). Länge 1.55 mm; Breite: 1.0 mm.

Beschreibung: Langoval, fast zylindrisch. Elytrenseiten sehr flach gerundet. Kopf gelbrötlich, deutlich genetzt, undeutlich punktiert. Mundwerkzeuge und Fühler gelbrötlich. Pronotum schwarz, seine Vorderwinkel rötlich, auf genetzter Oberfläche fein punktiert (Punkte kleiner als Augenfacetten). Behaarung weiß, ziemlich lang. Elytren schwarz mit braunrotem, verwaschenem Fleck hinter der Mitte wie Abb. 107. Elytrenhinterende schmal rötlich. Die dichte, sehr grobe Punktierung gibt der Oberfläche ein runzeliges Aussehen. Schulterbeule flach, Elytrenwölbung zum Seitenrand sehr steil. Unterseite schwarz mit braunrotem Abdomen. Aedeagus Abb. 21—23.

Differentialdiagnose: In der Form ähnlich den südafrikanischen Arten *N. binaevatus* Mulsant und *posticesignatus* Pope sowie der ostafrikanischen *N. stigma* Weise. Sie unterscheiden sich alle am männl. Aedeagus, *N. stigma* ist auf glatter Elytrenoberfläche stärker punktiert, die Schulterbeule ist kräftiger und die Körperform ist breiter.

Material: Holotypus: männl. Rwanda: Rusumo, Ibanda Makera 10. 1993 leg. Th. Wagner (ZFMK).

Nephus* (*Sidis*) *brevipilosus sp. n. (Abb. 25—33, 108)

Etymologie: lat. brevis = kurz; pilosus = behaart, wegen der kurzen, halb aufgerichteten Behaarung.

Diagnose: einfarbig dunkelrot, hochgewölbt und breit gerundet. Länge: 1,8—2.5 mm; Breite: 1.35—1.80 mm.

Beschreibung: Kopf gelb (männl.) oder schwarzrot (weibl.), sehr dicht und fein punktiert. Punkte kleiner als Augenfacetten. Sehr dicht gelb behaart. Pronotum rotbraun, auf glatter Oberfläche sehr dicht und fein punktiert, die weißen Haare nach hinten gerichtet. Pronotumseiten sanft geschwungen, vorne enger als an der Elytrenbasis, fein gerandet. Elytren von der Färbung und Behaarung des Pronotums. Auf fast glatter Oberfläche fein, aber weniger dicht punktiert als Pronotum. Punktzwischenräume größer als ihre Durchmesser. Schulterbeule ziemlich schmal und nicht sehr auffällig. Elytrenwölbung fällt fast senkrecht gegen den fein gekanteten Seitenranad ab. Gleichmäßig gerundet, in der Mitte am breitesten.

Differentialdiagnose: In der Größe nur der nächst verwandten Art *Nephus burgeoni* Mader sehr ähnlich. *N. burgeoni* ist aber schwarz gerandet, kann allerdings in seltenen Fällen auch ganz braunrot sein wie die neue Art. Die Behaarung von *N. burgeoni* ist steifer und vor allem hat diese Art einen kaum auffallenden Humeralcallus. Parameren von *N. brevipilosus* kürzer als bei *N. burgeoni*. Der Aedeagus der neuen Art weist gewisse Ähnlichkeit zu dem von *N. globulus* Fürsch auf, diese westafrikanische Art sieht aber völlig anders aus. Eine große äußere Ähnlichkeit besteht zu *Pseudoscymnus brunneus* sp. n.

Material: Holotypus: männl. Rwanda: Nyakabuye, Cyamudongo 10. 1993 auf *Carapa grandiflora* leg. Th. Wagner (ZFMK). 3 Paratypen mit den gleichen Daten (1 CF); 2 Paratypen: Rwanda: Karengera 1700 m 10. 1993 auf *Carapa grandiflora* leg. Th. Wagner (1 CF).

Nephus* (*Sidis*) *burgeoni (Mader)

Scymnus (*Nephus*) *burgeoni* Mader, 1950: 64
Scymnus (*Nephus*) *circumcinctus* Mader, 1950: 65. syn. nov.
Nephus (*Bipunctatus*) *circumcinctus* (Mader) — Fürsch 1992: 40. comb. nov.
Scymnus (*Sidis*) *longemaculatus* Mader, 1950: 59. — Fürsch, 1992: 40.

Tafel 2: 25—33: *Nephus brevipilosus* sp. n.: 25—29 Holotypus; 30—33 Paratypen; 33 Spermatheca (c). — 34—43 *Pseudoscymnus brunneus* sp. n. Paratypen: 43 Spermatheca (b).

Material: Lectotypus und 5 Paralectotypen von *N. burgeoni*: Rutshuru (MRAC, MGF, CF); Holotypus (männl.) von *S. circumcinctus*, Volc. Nyamuragira (IRSN), Lectotypus (männl.) von *S. longemaculatus*: Rwanda, Mt Tamira (Nähe Lac Gando) (MRAC) und viel Material aus Rwanda (leg. Th. Wagner, ZFMK, MRAC, MGF, ZSM, CF) enthält sowohl Tiere mit schwarzer Elytrenumrandung wie auch solche von der Färbung des *N. brevipilosus*, also ganz rotbraun. Die von Mader (1950: 65) angegebenen Differentialmerkmale beziehen sich lediglich auf Größe und Färbung der Unterseite und sind variabel. Mit *Nephus oblongosignatus* (Mulsant) hat diese Art, entgegen Maders Angaben, nichts zu tun (vgl. Chazeau, Etienne & Fürsch 1974: 273).

Pseudoscymnus brunneus sp. n. (Abb. 34-43, 109)

Etymologie: lat. brunneus = braun.

Diagnose: Breit, hochgewölbt, dunkel rotbraun, zart rötlich behaart. Länge 1.9—2.5 mm; Breite: 1.4—1.9 mm.

Beschreibung: Kopf gelbrot (Holotypus) oder auch rot, dicht und fein punktiert. Punkte kleiner als Augenfacetten. Dicht weiß behaart. Haare im oberen Drittel des Kopfes gegen die Augen gerichtet, davor zur Oberlippe. Pronotum ähnlich dicht punktiert, Oberfläche dazwischen fast glatt. Behaarung an den Seiten weiß, in der Mitte rot. Pronotumbreite an der Elytrenbasis am größten, fast gerade nach vorne verengt. Elytrenoberfläche deutlich reticuliert und deutlicher punktiert als Pronotum. Behaarung fein, schütter, rötlich. Schulterbeule breit, nicht besonders deutlich. Zwischen Humeralcallus und Elytrenseitenrand seicht konkav. Elytren hochgewölbt und breit gerundet. Elytrenseitenrand fein gekantet, dunkel. Aedeagus Abb. 34—36, 38, 39, 42.

Differentialdiagnose: Die neue Art ist von allen anderen afrikanischen schon in ihrer Größe und der einheitlich rotbraunen Färbung unterschieden. Die anderen Arten haben wenigstens ein etwas helleres Pronotum. Die männl. Genitalorgane unterscheiden sich von den übrigen Arten (vgl. Fürsch 1990). *P. brunneus* hat allerdings große äußerliche Ähnlichkeit mit der im gleichen Gebiet vorkommenden *Nephus brevipilosus* sp. n.

Material: Holotypus, männl.: Rwanda: Nyakabuye, Cyamudongo 10. 1993 leg. Th. Wagner (ZFMK). 11 Paratypen mit den gleichen Daten (3 CF).

Ortalia gracilis sp. n. (Abb. 44-47)

Etymologie: lat. gracilis = zierlich, wegen der in dieser Gattung geringen Größe.

Diagnose: Ober- und Unterseite einheitlich blaßgelb. Länge: 2.9 mm; Breite: 2.2 mm.

Beschreibung: Kopf auf glatter Oberfläche dicht punktiert. Punkte etwa von der Größe der Augenfacetten. Mandibelspitzen dunkelbraun. Auch auf den Augen weiß behaart. Pronotum sehr dicht punktiert, vor der Mitte am breitesten, zur Basis fast gerade sehr leicht verengt. Elytren langoval, hinter der wenig deutlichen Schulterbeule am breitesten, dann fast parallelseitig. Wie auf Pronotum weiß behaart. Punktierung regelmäßig und dicht.

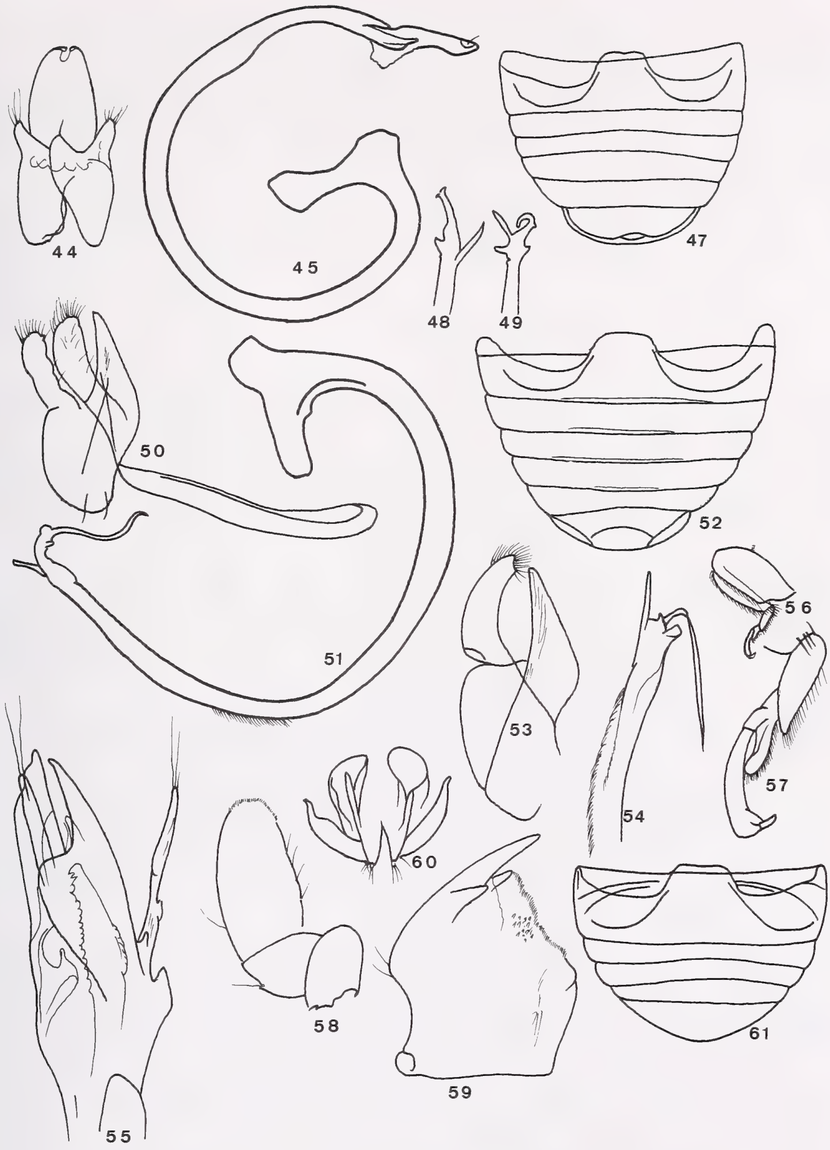
Differentialdiagnose: Sehr ähnlich den *Ortalia*-Arten, *argillacea* Mulsant (Abb. 50—52), *ochracea* Weise (Abb. 48, 49), *sjoestedti* Weise und *ovulum* Weise (Abb. 53, 54). Bei *Ortalia ovulum* ist der Seitenrand viel breiter, *O. ochracea* ist größer und stärker gerundet, *O. sjoestedti* ist länger behaart und auf der Unterseite schwarz. Ein gutes Differentialmerkmal ist die Siphospitze (Abb. 45).

Material: Holotypus, männl.: Rwanda: Rusumo, Ibanda Makera 10.1993 leg. Th. Wagner (ZFMK).

Telsimia striata sp. n. (Abb. 55-61, 110)

Etymologie: lat. striatus -a = gestreift.

Diagnose: gerundet, schwarz mit einem rötlichen nierenförmigen Fleck wie Abb. 110 auf jeder Elytra. Zottig weiß behaart. Länge: 1.3—1.4 mm; Breite: 1.1 mm.



Tafel 3: 44—47 *Ortalia gracilis* sp. n. Holotypus: 44 Tegmen ventral (b); 45 Sipho (c); 47 Abdomen (a). — 48, 49: *Ortalia ochracea*: 48 Siphospitze von dorsal gesehen, 49 von ventral. — 50—52: *Ortalia argillacea* von Ibanda Makera. — 53, 54: *Ortalia ovulum*, Kamerun, Joko. — 55—61: *Telsimia striata*, Paratypen: 55 Aedeagus (c); 56 Hinterbein (b); 57 Hintertarsus (c); 58 Kiefertaster (c); 59 Mandibel (c); 60 weibl. Genitalplatten (b); 61 Abdomen (b).

Beschreibung: Kopf dicht punktiert, Oberfläche dazwischen glatt, weiß behaart. Pronotum sehr dicht punktiert, Punkte größer als auf dem Kopf. Wirr weiß behaart. Pronotumseiten gerundet mit deutlicher Randkante. Elytrenpunktierung noch größer als auf Pronotum, Oberfläche dazwischen sehr fein genetzt, glänzend. Behaarung lang, aufrecht. Auf jeder Elytra ein brauner Fleck wie Abb. 110. Elytrenseiten breit gerundet, Schultern vorgezogen.

Differentialdiagnose: Durch ihre Zeichnung von allen anderen afrikanischen Arten leicht zu unterscheiden.

Material: Holotypus, männl. Rwanda: Cyamudongo, 1700 m auf *Carapa grandiflora* 10. 1993 leg. Th. Wagner (ZFMK). 4 Paratypen mit den gleichen Daten (1 CF); 1 Paratypus: Rwanda: Rusumo, Ibanda Makera 10. 1993 auf *Carapa grandiflora* leg. Th. Wagner (CF).

Boschalis wagneri Fürsch (Abb. 62—66, 111)

Boschalis wagneri Fürsch, 1995: 30, Abb. 49-52.

Diese von Herrn Thomas Wagner entdeckte Art wurde bereits von Fürsch (1995) ausführlich beschrieben; die Diagnose wird hier durch weitere Abbildungen ergänzt.

Material: Holotypus, männl.: Rwanda: Nyakabuye, Cyamudongo, 1700 m 10. 1993 auf *Carapa grandiflora* leg. Th. Wagner (ZFMK). 7 Paratypen mit den gleichen Daten (2 CF); 1 Paratypus: Rwanda: Rusumo, Ibanda Makera auf *Lannea fulva* (CF).

Scotoscymnus glabripilosus sp. n. (Abb. 67-70, 112)

Etymologie: lat. glaber = glatt; pilosus = behaart, wegen der im Vergleich zu anderen Arten relativ glatt nach hinten gerichteten Behaarung.

Diagnose: Dunkel rötlichbraun, langoval, Elytrenbehaarung regelmäßig nach hinten gerichtet. Länge: 1.3—2.0 mm; Breite: 0.9—1.4 mm.

Beschreibung: Kopf mit Punkten von der Größe der Augenfacetten ziemlich dicht besetzt, Oberfläche dazwischen glatt. Behaarung dünn, lang, weiß. Pronotumpunktierung noch etwas größer, aber weniger dicht als auf dem Kopf. Pronotum an den Seiten stark gerundet, hinter der Mitte am breitesten. Behaarung weiß, lang, zum großen Teil nach vorne gerichtet. Elytrenpunktierung und -behaarung wie auf Pronotum, aber Haare halbaufrecht und gleichmäßig nach hinten gerichtet. Elytrenseitenrand ziemlich breit und deutlich horizontal. Elytrenform länglich, vor der Spitze etwas eingezogen (gutes Merkmal!). 1. und 2. Abdominalsegment vereinigt, aber Trennlinien doch noch zu erkennen.

Differentialdiagnose: Ähnlich *S. rotundatus* (Weise), bei dem aber die Pronotumpunktierung schwächer, dafür Elytrenpunktierung viel stärker ist. Obwohl die neue Art sehr dunkel rotbraun sein kann, ist sie doch nie völlig schwarz wie *S. niger* (Weise). In der Behaarung sind die beiden Arten ähnlich. *S. niger* ist auf den Elytren stärker punktiert. Ein verläßliches Merkmal ist die Siphospitze (Abb. 70). *S. parvulus* (Weise) und *S. punctipennis* (Weise) haben auffallendere Seitenränder und andere Aedeagi. *S. minutus* (Fürsch) ist weniger deutlich punktiert als *S. glabripilosus* und zudem schon an seiner konischen Körperform (kurz hinter den Schultern am breitesten) gut zu erkennen.

Material: Holotypus, männl.: Rwanda: Karengera 1700 m auf *Carapa grandiflora* 10. 1993 leg. Th. Wagner (ZFMK). 8 Paratypen mit den gleichen Daten (2 CF); 1 Paratypus: Rwanda: Rusumo, Ibanda Makera 10. 1993 leg. Th. Wagner; 3 Paratypen: Rwanda: Nyungwe, Kamiranzovu 2000 m auf *Carapa grandiflora* 10. 1993 leg. Th. Wagner; 14 Paratypen: Rwanda: Cyamudongo 1700 m auf *Carapa grandiflora* 10. 1993 leg. Th. Wagner (4 CF).

Scotoscymnus maximus sp. n. (Abb. 71-76, 113)

Etymologie: lat. maximus = der Größte.

Diagnose: Gleichmäßig gerundet, dunkel rotbraun mit auffallend breitem Seitenrand. Länge: 1.5—1.7 mm; Breite: 1.1—1.4 mm.

Tafel 4: 62—66 *Boschalis wagneri*: 62 Paratypus Tegmen, schräg ventral (b); 63 id. Holotypus, lateral; 64—66 Paratypen; 66 weibl. Genitalplatte (b). — 67—70: *Scotoscymnus glabripilosus* sp. n. Paratypen. — 71—76: *Scotoscymnus maximus* sp. n. Paratypen. — 77—83: *Epilachna conspergata* sp. n.: 77—78 Holotypus; 79—83 Paratypen. Unter 77: Maßstäbe für alle Detailzeichnungen.

Beschreibung: Kopf mit Punkten von der Größe der Augenfacetten locker besetzt, weiß behaart. Pronotum an den Seiten stark gerundet, Punktierung ziemlich fein, ungleich. Pronotumbehaarung lang, dünn und wirr. Elytrenoberfläche fein genetzt mit viel größeren Punkten als auf dem Pronotum. Elytrenseitenrand besonders unter und hinter der undeutlichen Schulterbeule breit subhorizontal. Die gleichmäßig gerundeten Elytren sind kurz vor der Mitte am breitesten. Elytrenhaare lang, weißlichgelb, zum größten Teil nach hinten gerichtet.

Differentialdiagnose: Viel breiter gerundet als *S. glabripilosus* und mit breiterem Elytrenseitenrand. Beste Merkmale: Die gekrümmte Dorsalseite des Basallobus, schwache Schulterbeule, stark ausgeprägter Elytrenseitenrand.

Material: Holotypus: Rwanda: Nyakabuye, Cyamudongo 1700 m auf *Carapa grandiflora* 10. 1993 leg. Th. Wagner (ZFMK). 27 Paratypen mit den gleichen Daten (9 CF); 1 Paratypus: Rwanda: Karengera 1700 m, sonst gleiche Daten. Weiteres Material: Zaire: Kivu Sud, Irangi 900 m auf *Carapa grandiflora* 10. 1993 leg. Th. Wagner.

Epilachna conspergata sp. n. (Abb. 77-83, 114), *Epilachna sahlbergi*-Gruppe (vgl. Fürsch 1963)

Etymologie: Lat. conspergere = bestreuen, die Oberfläche sieht wie mit Pfeffer bestreut aus.

Diagnose: Oval, braun mit wolkig unregelmäßiger schwarzbrauner Zeichnung wie Abb. 114. Länge: 3.8—4.4 mm; Breite: 3.2—3.5 mm.

Beschreibung: Kopf gelb mit schwarzbraunem Fleck auf der Stirn, der halb vom Pronotum verdeckt ist (Holotypus, Paratypus), oder auch ganz schwarzbraun (Paratypus). Fein genetzt und mit feineren Punkten als die Augenfacetten. Pronotum mit Punkten von der Größe der Augenfacetten dicht besetzt. Pronotumbehaarung fein, weißlichgelb. Pronotum an den Seiten breit gerundet. Scutellum gelb, schwarz gerandet (Holotypus) oder ganz gelb. Elytrenpunktierung sehr dicht und größer als auf Pronotum. Behaarung kürzer als auf Pronotum. Humeralcallus sehr deutlich. Elytrenabdachung gegen den Seitenrand flach. Abdomen dunkelbraun, Beine heller. Siphospitze etwas variabel, wie in der Gruppe um *E. gyldenstolpei* (Weise) üblich.

Differentialdiagnose: In der Zeichnung sehr ähnlich *E. zumpti* Fürsch (1963). Bei dieser Art sind die Pronotumseiten gerade, während sie bei der neuen Art auffallend gerundet sind. Wichtigstes Differentialmerkmal: Markanter Höcker an der Basis des Basallobus bei *E. zumpti*, wogegen die neue Art hier kaum eine flache Erhebung zeigt. Die Elytrenpunktierung ist bei *E. conspergata* etwas stärker als bei *E. zumpti*.

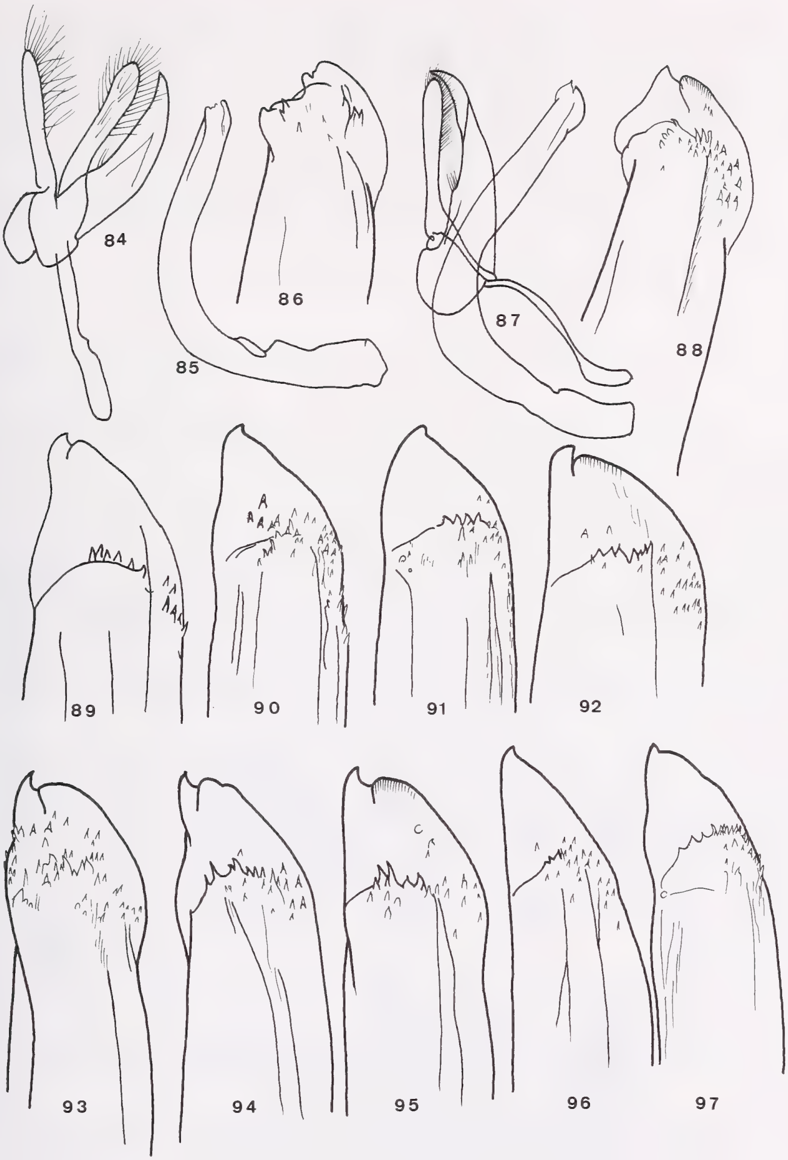
Material: Holotypus, männl.: Rwanda: Nyungwe, Kamiranzovu 2000 m auf *Carapa grandiflora* 10. 1993 leg. Th. Wagner (ZFMK). 1 Paratypus mit den gleichen Daten (CF); 2 Paratypen: Rwanda: Karengera 1700 m auf *Carapa grandiflora* 10. 1993 leg. Th. Wagner (1CF); 1 Paratypus: Rwanda: Nyakabuye 28. 10.—2. 11. 1983 leg. H. Mühle (CF).

Epilachna apiceoculata sp. n. (Abb. 84-86, 115), *Epilachna sahlbergi*-Gruppe

Etymologie: lat. apex, apicis = Spitze; oculatus = mit Augenflecken versehen, wegen der auffälligen Zeichnung an der Elytrenspitze.

Diagnose: Braun mit schwarzer Zeichnung wie Abb. 115. Basallobus auffallend dick. Länge: 3.3 mm; Breite: 2.6 mm.

Beschreibung: Kopf in der Mitte schwarz, neben den Augen braun, dicht punktiert und behaart. Oberlippe, Fühler und Mundwerkzeuge braun. Pronotum braun, gelbweiß und lang behaart. Pronotumseitenrand sanft gerundet, seine Oberfläche kaum sichtbar genetzt, aber dicht punktiert. Punkte von der Größe der Augenfacetten und durch Zwischenräume dieser Größe voneinander getrennt. Scutellum braun. Elytren braun mit schwarzer Zeichnung wie Abb. 115. Ebenso dicht und etwas größer punktiert als Pronotum. Behaarung wie auf Pronotum. Humeralcallus sehr auffällig. Die Elytrenwölbung fällt steil zum nicht gekanteten Seitenrand ab. Elytren hinter der Mitte am breitesten. Unterseite und Beine braun. Femorallinie ein gleichmäßiger Bogen, der $2/3$ der Länge des ersten Abdominalsternits einschließt und beinahe den Vorderrand erreicht.



Tafel 5: 84—86 *Epilachna apiceoculata* sp. n. Holotypus; 87—97 *Epilachna gyldenstolpei*: 87, 88: Kivu, Shibinda; 89 Butembo; 90 Irangi; 91 Nyakabuye; 92 Parc Nat. des Volcans, Lubero; 94, 95 Ruwenzori; 96 Virunga; 97 Nyakabuye.

Differentialdiagnose: In der Verwandtschaft um *Epilachna gyldenstolpei* (Weise) (vgl. Fürsch 1963) ist es bei der Variabilität der Zeichnung und der Siphospitzen sehr schwierig, Arten abzugrenzen. *Epilachna apiceoculata* ist habituell sicher nicht zweifelsfrei zu erkennen, zumal das einzige vorliegende Expl. keine Hinweise auf die Variabilität zuläßt. Das beste Merkmal ist der dicke Basallobus. Das Problem bei diesen Arten ist die Variabilität der Siphospitzen. Wagners Ergebnisse erlauben, zusammen mit dem ungeheuren Material des MRAC, eine Darstellung dieser Variabilität (Abb. 87—97). Auch in Form und Färbung des Körpers sind die Arten variabel, ganz besonders *E. gyldenstolpei.* Bei letzterer ist die Elytrenwölbung flacher, besonders zum Seitenrand hin. *E. aulisoides* (Weise) ist weniger deutlich punktiert, und die Schulterbeule ist flacher.

Material: Holotypus: Rwanda: Prov. Cyangugu, Umgebg. Nyakabuye 13.—15. 5. 1985 leg. H. Mühle. Gen. Präp. Nr. 3153 (ZSM)

Epilachna carapacola sp. n. (Abb. 98, 99, 116, 117), *Epilachna canina*-Gruppe (vgl. Fürsch 1985a)

Etymologie: Zusammengezogen aus *Carapa* = Baumgattung und lat. incola = Bewohner.

Diagnose: Ockerbraun mit schwarzbrauner, unvollständiger Netzzeichnung wie Abb. 116, 117. Länge: 5.2—6.1 mm; Breite: 4.6—4.8 mm.

Beschreibung: Kopf rotbraun, sehr dicht punktiert. Punkte etwa von der Größe der Augenfacetten, Oberfläche dazwischen kaum mehr sichtbar. Mundwerkzeuge schwarz mit braunen Rändern. Pronotum rotbraun, ebenfalls sehr dicht punktiert. Behaarung wie auf Kopf weiß, ziemlich lang, aber zart. Innerhalb des aufgewulsteten Pronotumseitenrandes eine flache Depression. Elytren heller als Kopf und Pronotum. Elytrenpunktierung sehr dicht, die gröberen Punkte etwa 4mal so groß wie auf dem Pronotum, die kleineren etwa so groß wie auf dem Pronotum. Das schwarze Netz sehr unvollständig wie Abb. 116, 117. Elytrenseitenrand ganz schmal gewulstet, schwarz, daneben sanft eingemuldet. Femorallinie nahezu vollständig. Unterseite und Beine schwarz, Abdomenseiten braun.

Differentialdiagnose: Ausgezeichnet durch stark unvollständige Elytrenzeichnung, Siphospitze ohne Serra (Fürsch 1985a: 193) und einen Basallobus, der steiler abfällt als bei einer anderen Art. Nach der Tabelle von Fürsch (1985a) käme man zur südafrikanischen *Epilachna dregei* Mulsant, die aber eine viel längere Lobusspitze hat, abgesehen von der vollständigeren Elytrenzeichnung.

Material: Holotypus, männlich: Rwanda: Cyamudongo, 1700 m auf *Carapa grandiflora* 10. 1993 leg. Th. Wagner (ZFMK). 1 Paratypus weibl. (ZFMK), 1 männl. (CF) mit den gleichen Angaben.

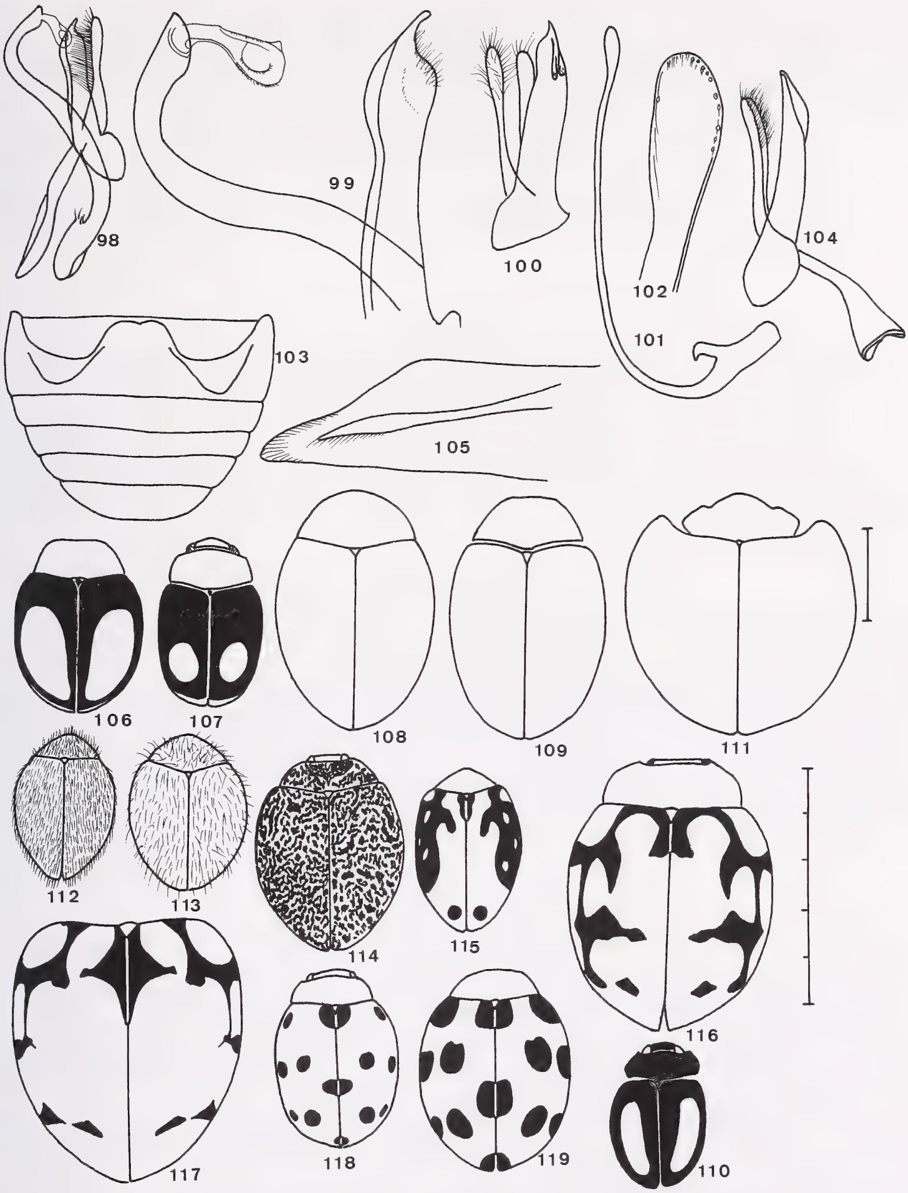
Afidenta muehlei sp. n. (Abb. 100—105, 118)

Etymologie: Dem Entdecker Hans Mühle, München, gewidmet, der ein Forstprojekt in Rwanda wissenschaftlich betreut hat und dabei eine höchst bemerkenswerte Ausbeute mitbringen konnte.

Diagnose: Rot, auf den Elytren mit zusammen 13 kleinen schwarzen, runden Flecken wie Abb. 118. Länge 3.3—3.4 mm; Breite: 2.6—2.7 mm.

Beschreibung: Kopf gelb (Holotypus) oder rot mit flachen Punkten, die etwas größer sind als die Augenfacetten, fein genetzter Oberfläche und goldgelber Behaarung. Pronotum rot, in den Vorderwinkeln gelb und auf glatter Oberfläche etwa in gleicher Größe wie auf Kopf punktiert. Elytren rot mit kleinen schwarzen, runden Flecken wie Abb. 118, so stark und ungleichmäßig punktiert, daß sie auch bei stärkerer Vergrößerung rauh erscheinen. Elytrenseitenrand schmal horizontal. Schulterbeule deutlich. Femorallinie Abb. 103. Aedeagus: Spitze des Basallobus leicht paramerenwärts gekrümmt.

Differentialdiagnose: Von *Afidenta maderi* (Korschefsky) kaum zu unterscheiden, letztere Art hat auf der Naht nur zwei gemeinschaftliche Flecken und die neue Art drei. *Afidenta malawiensis* Fürsch (1996) hat wohl größere Flecken, ist aber im Aedeagus ähnlich.



Tafel 6: 98—99: *Epilachna carapacola* sp. n. Holotypus: 98 Aedeagus (a); 99 Tegmen (b). — 100—105: *Afidenta muehlei* sp. n.: 100—103 Holotypus; 104, 105 Paratypus. — 106—119: Umrißskizzen: Maßstab für 106—113 neben Abb. 111 = 1 mm; Maßstab für 114—119 neben Abb. 116 = 5 mm. 106 *Scymnus rwandensis*; 107 *Nephus rugulipennis*; 108 *Nephus brevipilosus*; 109 *Pseudoscymnus brunneus*; 110 *Telsimia striata*; 111 *Boschalis wagneri*; 112 *Scotoscymnus glabripilosus*; 113 *Scotoscymnus maximus*; 114 *Epilachna conspergata*; 115 *Epilachna apiceoculata*; 116, 117 *Epilachna carapacola*; 118 *Afidenta muehlei*; 119 *Afidenta scitula*.

In der Tabelle von Fürsch (1986) käme man zur äußerlich gleichen westafrikanischen *Afidenta scitula* (Weise) (Abb. 119), aber deren Aedeagus ist völlig verschieden, und ihre Pronotumränder sind stärker aufgebogen, auch die Punktierung ist etwas gröber als bei der neuen Art. Diese äußerliche Gleichheit zweier Arten ist bei dieser Gattung keineswegs neu (vgl. Fürsch 1986).

Material: Holotypus, männl.: Rwanda: Prov. Cyangugu, Umgebg. Nyakabuye 13.—15. 5. 85 leg. H. Mühle Gen. Präp. 3160 (ZSM). 2 Paratypen: gleiche Angaben, aber 10. 1. 1986, 1 Paratypus: 30. 1.—3. 2. 1984 (CF). Weiteres Material: Rwanda: Rangiro 9. 1976 leg. Werner (CF), bei Fürsch (1986: 90) als *Afidenta scitula* angegeben. Letztere Art bleibt damit auf Westafrika beschränkt.

Danksagung

Herrn Thomas Wagner sei auch hier nochmals herzlich für die Möglichkeit gedankt, seine Ausbeute bearbeiten zu können. Besonderen Dank schulde ich Herrn Hans Mühle für die Überlassung seiner großen und wertvollen Aufsammlung. Ohne die bereitwillige und verständnisvolle Zusammenarbeit mit den großen Museen wären taxonomische Arbeiten heute nicht mehr denkbar, deshalb danke ich den Leitern dieser Institute ganz besonders. Es sind die Damen und Herren Dres. H. André, Tervuren, M. Baehr, München, Nicole Berti, Paris, R. G. Booth, London, M. Cludts Bruxelles, R. L. Davidson, Pittsburgh, H. Silfverberg, Helsinki und M. Uhlig, Berlin.

Zusammenfassung

Die Coccinellidenausbeute, die Thomas Wagner in Rwanda und Ostzaire vor allem durch Benebeln der für bestimmte Phytozönosen charakteristischen Baumarten mit Pyrethrum sammeln konnte, wurde hier bearbeitet. Dazu wurde weiteres Material von Hans Mühle aus Rwanda ausgewertet. Folgende neue Arten werden beschrieben und abgebildet: *Afidenta muehlei*, *Boschalis wagneri*, *Epilachna carapacola*, *Epilachna conspergata*, *Nephus brevipilosus*, *Nephus rugulipennis*, *Ortalia gracilis*, *Pseudoscymnus brunneus*, *Scotoscymnus glabripilosus*, *Scotoscymnus maximus*, *Scymnus rwandensis*, *Telsimia striata*. Neue Synonyme: *Scymnus luniferus* Sicard ist jüngeres Synonym von *Scymnus usambaricus* Weise und *Scymnus* (*Nephus*) *circumcinctus* Mader ein jüngeres Synonym von *Nephus* (*Sidis*) *burgeoni* Mader.

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Neue Glasflügler (Lepidoptera, Sesiidae) aus dem Pamir und dem Hindukusch

K. Špatenka

Abstract. Five new species of clearwing moths from Central Asia are described. *Bembecia pashtuna* sp. nov. from Pakistan, Baluchistan, is closely related to *B. dispar* and *B. tsvetajevi*; the larva lives in *Astragalus lacei. B. aloisi* sp. nov. originates also from Baluchistan and the larva lives in *Onobrychis dealbata*. It forms part of the *B. ichneumonisformis*-group and resembles *B. zebo*. The same applies to *B. karategina sp.* nov. which was collected by a single pair from Tadzhikistan. Its larval bionomy remains unknown. *Chamaesphecia mudjahida* sp. nov. is only known from a single specimen from Afghanistan (Nuristan). It is similar in wing shape to *Ch. mutilata*, but is more loosely related to *Ch. masariformis*. Its larval bionomy remains also unknown. *Ch. weidenhofferi* sp. nov. from SW-Uzbekistan ist related to *Ch. zimmermanni* and *Ch. ferganae*. The larva lives in *Phlomis betonicifolia*.

Key words. Lepidoptera, Sesiidae, clearwing moths, systematics, Pamir, Hindukush.

Zusammen mit A. Pavlíčko (Prachatice) und Z. Weidenhoffer (Praha) unternahm ich 1992 eine Sammelreise in einige Gebirge Pakistans, in deren Verlauf es gelang, zwei neue Glasflügler-Arten zu entdecken. Für beide konnte auch die Larvalbionomie geklärt werden. Die Beschreibungen beider Taxa ergänze ich um drei weitere Beschreibungen neuer Arten aus Afghanistan, Tadzhikistan und Uzbekistan. Obwohl von den ersten zwei nur sehr wenig Material zur Verfügung steht, habe ich mich entschlossen, diese Arten zu beschreiben, da sie aus Gebieten stammen, bei denen nur sehr geringe Aussichten bestehen, weiteres Material zu erhalten.

Bembecia pashtuna sp. n. (Abb. 1, 2)

Material. Holotypus ♂, Pakistan, Baluchistan, 7 km O Ziarat, ca 150 km N Quetta, 2500—2700 m, ex p. 29. 6. 1992, coll. Museum Witt, München[1]; Paratypen: 10 ♂♂, 4 ♀♀, gleicher Fundort, 19.—24. 6. 1992, davon 1 ♀ in coll. A. Kallies; 1 ♂, gleicher Fundort, 15. 6. 1992; 3 ♂♂, gleicher Fundort, 16. 6. 1992, Anflug an Pheromon Nr. 15 (Dr. Priesner); 1 ♂, gleicher Fundort, 16. 6. 1992, Anflug an Pheromon Nr. 16 (Dr. Priesner); 4 ♂♂, gleicher Fundort, 18. 6. 1992, Anflug an Pheromon Nr. 5 (Dr. Priesner), alle K. Špatenka leg. in coll. K. Špatenka und Museum Witt, München; 1 ♀, Afghanistan, Hazarajat, Koh-i-Baba, Shahtu-Kotal, 4000 m, 20.—21. 6. 1961, G. Ebert leg., in coll. Zoologische Staatsammlung, München; 1 ♀ NO-Afghanistan, Badachschan, Khinsch-e-Andarab, 3500—4000 m, 21. 7. 1957, G. Ebert leg., in coll. Zoologische Staatssammlungen, München (bei diesem Exemplar fehlt das Abdomen).

Männchen. Spannweite 20,0 mm. Kopf: Labialpalpus dorsal schmutzigweiß, 3. Glied apikal schwarz, innen weißlich, außen schwarz mit langen haarförmigen Schuppen; Stirn schwarz mit einzelnen weißlichen Schuppen vor dem Auge; Scheitel schwarz, dicht mit langen weiß-

[1] Die umfangreichen Sammlungen des Museums Witt in München werden zu gegebener Zeit an die Zoologische Staatssammlung in München transferiert.

lichen Haarschuppen bedeckt; Antenne schwarz mit sehr langen Cilien, ventral mit einzelnen ockergelben subapikalen Schuppen.

Thorax: schwarz; Metathorax mit schmalen, langen, schmutziggelben Haarschuppen; Patagia lateral mit einzelnen weißlichen Schuppen. Vorderbein schwarz, Femur mit langen grauen Haarschuppen, Tibia und Tarsus ventral mit ockergelben Schuppen durchsetzt. Hinterbein schwarz, Coxa und Femur mit grauen Haarschuppen, Tibia ventral mit einzelnen weißlichen Schuppen, Tarsus mit ockergelben Schuppen durchmischt, die 1. Tarsomere ventral weißlich, Sporne schwarz.

Vorderflügel: braunschwarz mit schwach entwickelten Glasfeldern. Costalrand, das Apikalfeld, Diskalfleck und Cubitalstamm schwarz, Fransen lang, dunkelbraun, Analrand und die Adern M1, M2 im äußeren Glasfeld (ETA) ockergelb bestäubt. Das hintere Glasfeld (PTA) nur rudimentär, das Keilfeldchen auf etwa die Hälfte verkürzt, das ETA breiter als hoch, durch die Adern in 3 Zellen geteilt, etwa so breit wie der Diskalfleck und das Apikalfeld; Costalrand unterseits weißlich, Analrand ockergelb, Diskalfleck, Apikalfeld und die Adern im ETA schwarz; Fransen dunkelbraun, leicht schmutziggelb durchmischt.

Hinterflügel: hyalin, die Adern, die langen Fransen, der breite Außenrand sowie der breite keilförmige Diskalfleck dunkel braunschwarz; unterseits von gleicher Färbung, Adern und der Diskalfleck mit sehr spärlichen ockergelben Schuppen.

Abdomen: schwarz, die Hinterränder der Tergite 4, 6 und 7 schmal weißlich beschuppt; ventral schwarz, das vierte Sternit mit schmutziggelbem Hinterrand, der aber medial unterbrochen ist, das siebte Sternit mit einzelnen weißlichen Schuppen am Hinterrand; der Analbusch schwarz, medial mit einzelnen schmutzig gelbweißen Schuppen, Valven gelbweiß.

Weibchen. Körper, Flügel, Beine, Antennen und Labialpalpen dunkel braunschwarz; einzelne schmutziggelbe Schuppen auf der Stirn und dorsolateral an den Hinterrändern der Abdominaltergite 4 und 6, schwache schmutzigweiße Bestäubung auch dorsal auf den Palpengliedern 1—2.

Variabilität. Spannweite 18,0—22,5 mm. Die Weibchen variieren sehr wenig, die Männchen stärker, einige haben mehr oder weniger ausgeprägte helle Bestäubung. Das Extrem bildet ein Männchen mit schmutzigweißen Beinen (nur Hintertibia mit schwarzem Ring). Bei diesem Stück finden sich auf der Außenseite des Diskalfleckes einzelne ockergelbe Schuppen, das ETA ist länger und breiter, mit einer rudimentären vierten Zelle, die Analader und die Flügelwurzel am Analrand des Hinterflügels ockergelb bestäubt, die hellen Ringe auf dem Abdomen breiter und nicht nur weißlich, sondern proximal leicht gelblich, der Analbusch in der Mitte deutlich ockergelb durchmischt. Zwischen der typischen und der Extremform der Männchen sind Übergangsformen zu finden. Bei einem Weibchen ist die braunschwarze Bestäubung des Vorderflügels an der Stelle des Keilfeldchens weniger dicht.

Genitalapparat ♂ (Abb. 9). Valve mittelbreit, mit gerundetem Apex, die kahle Fläche dorsal einfach-konkav gewölbt, Crista sacculi gerade, schmal, apikal zugespitzt, nicht den Ventralrand der Valve erreichend, die Dorsalkante im basalen Drittel mit kräftigen Borsten bestanden, die subapikal quer über die ganze Breite der Crista eine Linie bilden; Gnathos einfach, mit löffelförmigen Lateralkanten, Crista medialis schwach entwickelt; Aedeagus sehr schlank.

Genitalapparat ♀. Nicht untersucht.

Differentialdiagnose. Die neue Art ist mit einer Gruppe deserticoler Arten, wie *B. dispar*, *B. syzcjovi*, *B. tsvetajevi* und *B. deserticola*, verwandt. Hierher gehören wahrscheinlich auch *B. tshimgana* und *B. vidua*. Phänotypisch ähnelt das Weibchen der neuen Art am meisten *B. dispar* und *B. tsvetajevi*, teilweise auch *B. vidua*, das Männchen nur den dunklen Formen von *B. tshimgana*. Das Männchen von *B. tshimgana* hat eine gelbe Halskrause (bei *B. pashtuna* sp. n. schwarz), gelb begrenzte Tegulae (bei *B. pashtuna* sp. n. schwarz), der Metathorax (bei *B. pashtuna* sp. n. schwarz) und auch weitere Körperteile sind gelb statt weiß; dagegen ist der Analrand des Vorderflügels bei *B. tshimgana* braunschwarz und nicht schmutziggelb. Von *B. vidua* ist nur der Holotypus bekannt, ein einzelnes Weibchen nicht ganz klarer Herkunft (Samarkand). Dieses Exemplar ist ebenfalls braunschwarz, hat aber teilweise durchsichtige Vorderflügel und fast ganz durchsichtige Hinterflügel. Trotzdem kann man nicht aus-

schließen, daß *B. pashtuna* nur eine Subspecies von *B. vidua* darstellt. Diese taxonomische Frage ist jedoch ohne weiteres Material von *B. vidua* und ohne Kenntnisse der Bionomie dieser Art nicht lösbar. Das Weibchen von *B. dispar* aus Nordafrika ist im Durchschnitt größer (27 mm) und hat vollständig braunschwarze Beine und ein ebenso gefärbtes Abdomen (bei *B. pashtuna* mit heller Beimischung); bei *B. dispar* ist das dritte Palpenglied schwarz und die Stirn rein weiß, bei *B. pashtuna* schwarz, und die Stirn hat nur einzelne helle Schuppen. Beim Weibchen von *B. dispar* kommen sehr oft Stücke mit einer kleinen durchsichtigen Fläche zwischen den Adern M3-Cu2 im Hinterflügel vor, bei *B. pashtuna* ist hingegen die ganze Flügelfläche braunschwarz. Die ♀♀ von *B. tsvetajevi* treten in zwei Formen auf, einer gelben und einer schwarzen. Die letztgenannte Form ähnelt *B. pashtuna*. Sie unterscheiden sich aber durch die gelbe Stirn sowie die gelbe Halskrause. Ähnlich wie *B. dispar* ist auch *B. tsvetajevi* im Durchschnitt größer (27 mm).

Bionomie. Die Raupe ist zweijährig und lebt in den dicken Wurzeln des seltenen, bis 1,5 m hohen, gelbblühenden *Astragalus lacei*, manchmal zahlreiche Raupen in einer einzigen Wurzel (ähnlich wie *B. tshimgana* oder *B. dispar*). Sie baut ein Röhrchen aus Wurzelspänen, das innen fein ausgesponnen ist und das manchmal einige Millimeter aus dem Wurzelkopf herausragt. Die Verpuppung findet in einer kleinen Kammer im Proximalende dieses Röhrchens statt. Die Imagines schlüpfen in der zweiten Junihälfte und vermutlich auch noch im Juli. Sie fliegen vormittags (8.30—11.30) an künstliche Sexual-Pheromone an.

Habitat. Lichte *Juniperus*-Wälder und verlassene Gärten an Abhängen mit nördlicher Exposition, unter dem Ziarat-Paß in Baluchistan in Höhen zwischen 2500—2700 m über NN, wo die Futterpflanze sehr vereinzelt vorkommt. Zusammen mit der neu beschriebenen Art fliegt auf den Lokalitäten auch häufig *Chamaesphecia xanthosticta* (Hampson, [1893]) und vereinzelt *B. aloisi* sp. n.

Verbreitung. Bisher wenig bekannt, wahrscheinlich im ganzen Hindukusch-System verbreitet. Aus sesiidologischer Sicht stehen die Arten Baluchistans in sehr enger Beziehung zu denen des westlichen Pamir-Alai-Gebietes. So fliegt die bemerkenswerte rotorange Form von *Bembecia stiziformis tenebrosa* (Püngeler, 1914), die bisher nur aus Aman Kutan südlich von Samarkand bekannt war, ebenfalls am Ziarat-Paß. Weiterhin erwies sich die aus Baluchistan beschriebene *Sesia ommatiaeformis* (Moore, 1891) als identisch mit *Sesia shugnana* (Sheljuzhko, 1943) aus Chorog (Westpamir). Bisher ist aus Baluchistan kein Vertreter der orientalischen Glasflüglerfauna bekannt geworden.

Derivatio nominis. Die Art ist dem Stamm der Pashtunen gewidmet, deren Siedlungsgebiet großräumig mit dem bisher bekannten Areal von *B. pashtuna* zusammenfällt.

Bembecia karategina sp. n. (Abb. 3, 4)

Material. Holotypus ♂, Tadzhikistan, Karategin Kette, Romit Tal, 38.40° N, 69.10° O, 1500 m, 12. 7. 1981, J. Vaněk leg.; 1 ♀ Paratypus, wie oben; beide in coll. Museum Witt, München. Der Holotypus ♂ und der Paratypus ♀ wurden in copula gefunden, so daß die Konspezifität der beiden Exemplare gesichert ist.

Männchen. Spannweite 22 mm. Kopf: Labialpalpus dorsal weißgelb, ventral ockergelb, das erste und zweite Glied außen dicht schwarz beschuppt; Antenne schwarz; Stirn braun, vor dem Auge weißgelb; Scheitel schwarz, mit langen ockergelben Haarschuppen; Halskrause ockergelb.

Thorax: schwarz; Tegulae am Innenrand schmal gelb gesäumt; Scapularfleck weißgelb. Vorderbein: Coxa dorsal gelb, ventral schwarz; Femur braunschwarz, dorsal reich gelb beschuppt; Tibia ockergelb mit kleinem dunklem Punkt; Tarsus ockergelb. Hinterbein: Coxa und Femur braunschwarz, Tibia ockergelb, distal mit breitem schwarzem Band; Tarsus ockergelb.

Vorderflügel: sehr charakteristisch geformt, der Außenrand nicht wie gewöhnlich konkav gewölbt, sondern fast gerade, dadurch der Apex sehr scharf; Costalrand breit schwarz beschuppt; Diskalfleck breit, schwarz, nur am Außenrand schmal ockergelb begrenzt; der Cubitalstamm, die Adern im Apikalfeld und der schmale Außenrand schwarz; der Analrand und das mittelbreite Apikalfeld ockergelb; Keilfeldchen gut entwickelt; PTA kurz; ETA breiter

als hoch, breiter als Apikalfeld, die Adern im ETA gelb (M1, M2) bzw. schwarz (M3). Sie teilen das ETA in 4 leicht ockergelb bestäubte Zellen. Unterseite ähnlich, der Vorderrand dicht ockergelb bestäubt.

Hinterflügel: durchsichtig, mit schwarzen Adern, schmalem Außenrand und breitem keilförmigen Diskalfleck, der den Aderstiel M3-Cu1 erreicht; die Adern und der Analrand unterseits dicht ockergelb bestäubt.

Abdomen: schwarz; das zweite Tergit mit schmalem, zitronengelbem Ring; viertes Tergit in der Distalhälfte zitronengelb; fünftes medial mit einzelnen Schuppen gleicher Farbe; sechstes Tergit fast und siebtes ganz zitronengelb; Analbusch schwarz, medial mit zitronengelbem Strich. Ventral das zweite Sternit distal sehr schmal gelb begrenzt; die Sternite 4—7 mit breiten zitronengelben Bändern.

Weibchen. Spannweite 25 mm, sehr dimorph. Antenne in der Mitte braun; Labialpalpus und Stirn zitronengelb; Scheitel ockergelb; Halskrause ockergelb; Tegulae im Prothorakalbereich ockergelb.

Thorax: lateral ganz zitronengelb; Scapularfleck weißgelb; Metathorax breit ockergelb; Vorderbein zitronengelb; Hinterbein dorsal zitronengelb, Tibia distal mit undeutlichem schwarzem Band; ventral ist dieses Band kontrastreich und der Tarsus braun.

Vorderflügel: Glasfelder deutlich ausgeprägt; Vorderrand, Außenrand, Cubitalstamm, die Adern im ETA, das Apikalfeld und die innere Hälfte des Diskalfleckes dunkelbraun; Analrand ockergelb; Diskalfleck in der Außenhälfte orangegelb. Der Costalrand ventral leicht ockergelb bestäubt; zwischen den Adern im Apikalfeld kurze ockergelbe Strahlen.

Hinterflügel: durchsichtig mit dunkelbraunen Adern, schmalem Außenrand und langen Fransen; der Diskalfleck sehr schmal keilförmig, dunkelbraun, ventral ockergelb bestäubt.

Abdomen: schwarz; das zweite Tergit in der Distalhälfte zitronengelb, fünftes Tergit mit schmalem zitronengelbem Ring, sechstes Tergit in den hinteren zwei Dritteln zitronengelb; Analbusch zitronengelb, nur lateral schwarz. Sternite 5 und 6 fast ganz, 2 und 4 ganz zitronengelb; das dritte Sternit distal schmal zitronengelb umrandet.

Variabilität. Unbekannt.

Genitalapparat. Nicht untersucht.

Differentialdiagnose. Das Männchen ähnelt ein wenig *B. zebo* aus der Turkestan-Kette (Tadzhikistan und Uzbekistan). Diese Art zeichnet sich aber durch einen konkaven Außenrand des Vorderflügels, ein großes ETA, einen wesentlich schmaleren Diskalfleck des Vorderflügels und einen sehr schwach entwickelten Diskalfleck des Hinterflügels aus. Besonders aufgrund

Abb. 1—8: Imagines der neuen Glasflügler. — Abb. 1: *Bembecia pashtuna* sp. n., Holotypus ♂. Pakistan, Baluchistan, 7 km O Ziarat, ca 150 km N Quetta, 2500—2700 m, ex pupa 29. 6. 1992, leg. K. Špatenka (coll. Museum Witt, München). — Abb. 2: *Bembecia pashtuna* sp. n., Paratypus ♀. Pakistan, Baluchistan, 7 km O Ziarat, ca. 150 km N Quetta, 2500—2700 m, ex pupa 19.—24. 6. 1992, leg. et coll. K. Špatenka (Praha). — Abb. 3: *Bembecia karategina* sp. n., Holotypus ♂. Tadzhikistan, Karategin-Kette, Romit-Tal, 38.40° N, 61.90° O, 1500 m, 12. 7. 1981, leg. J. Vaněk (coll. Museum Witt, München). — Abb. 4: *Bembecia karategina* sp. n., Paratypus ♀. Tadzhikistan, Karategin-Kette, Romit-Tal, 38.40° N, 61.90° O, 1500 m, 12. 7. 1981, leg. J. Vaněk (coll. Museum Witt, München). — Abb. 5: *Bembecia aloisi* sp. n., Holotypus ♂. Pakistan, Baluchistan, Ziarat-Paß 9 km O Ziarat, 2700 m, ex pupa 23. 6. 1992, leg. K. Špatenka (coll. Museum Witt, München). — Abb. 6: *Chamaesphecia mudjahida* sp. n., Holotypus ♂. Afghanistan, Nuristan: Bashgal, Menalgal, Dandizenor Mts., 2200—3000 m, 27.—29. 5. 1972, leg. C. M. Naumann, coll. Nr. 1217 (coll. ZFMK). — Abb. 7: *Chamaesphecia weidenhofferi* sp. n., Holotypus ♂. Uzbekistan, 20 km SW Guzar, Gumbulak, 38.30° N, 66.21° O, 750 m, 3. 6. 1995, leg. K. Špatenka (coll. Museum Witt, München). — Abb. 8: *Chamaesphecia weidenhofferi* sp. n., Paratypus ♀. Uzbekistan, 20 km SW Guzar, Gumbulak, 38.30° N, 66.21° O, 750 m, 3. 6. 1995, leg. K. Špatenka (coll. Museum Witt, München).


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der Flügelform ähnelt *B. karategina* keiner der bisher bekannten *Bembecia*-Arten. Das Weibchen ist durch das schmale braune Apikalfeld und das zitronengelbe vierte Tergit sowie die Färbung des Abdomens auf der Ventralseite sehr charakteristisch.

Bionomie und Habitat. Die Larvalbionomie ist unbekannt; das vorliegende Paar wurde in einer bunten waldsteppenartigen Vegetation am Nordhang der Karategin-Kette im Kafirnagan-Tal, ca 30 km östlich von Dushanbe, sitzend gefunden.

Anmerkung: Der Typenfundort ist schon seit mehreren Jahren wegen des Krieges in Tadzhikistan unzugänglich, so daß es kaum Aussicht auf weiteres Belegmaterial gibt. Deswegen habe ich mich entschieden, die neue Art nach nur einem Pärchen zu beschreiben. Gleiche Gründe führen mich auch zur Beschreibung der folgenden Art.

Derivatio nominis. Die Benennung erfolgt nach dem Fundgebiet, der Karategin-Kette in Tadzhikistan.

Bembecia aloisi sp. n. (Abb. 5)

Material. Holotypus ♂, Pakistan, Baluchistan, Ziarat-Paß 9 km O Ziarat, 2700 m, 23. 6. 1992 ex p., coll. Museum Witt, München; Paratypen: 1 ♂ gleiche Daten, 18. 6. 1992, Anflug an „*tipuliformis*“-Pheromone (Wageningen); 2 ♂♂, 8 km O Ziarat, 2650 m, 18. 6. 1992, unspezifisch im Anflug an künstliche Pheromone; 1 ♂, 7 km O Ziarat, 2600 m, 18. 6. 1992, unspezifisch im Anflug an künstliche Pheromone, alles K. Špatenka leg. et coll.

Männchen. Spannweite 18—20 mm. Kopf: Antenne schwarz, subapikal mit einzelnen ockergelben Schuppen; Labialpalpus blaßgelb, das dritte Glied schwarz durchmischt, das erste und zweite Glied außen schwarz, mit sehr langen Haarschuppen; Stirn weißgelb; Scheitel schwarz und mit dünnen grauen Haarschuppen bedeckt; Halskrause lateral kürzer und gelb, dorsal lang und grau.

Thorax: schwarz mit dichten, langen, grauen Haarschuppen; Scapularfleck hellgelb; Patagia lateral hellgelb, an der Basis des Vorderflügels ein gelber Haarpinsel; Metathorax mit sehr langen, gelbgrauen, dünnen Haarschuppen. Vorderbein: Coxa schwarz mit langen grauen Haaren, dorsal und apikal hellgelb; Femur schwarz; Tibia und Tarsus hellgelb. Hintercoxa und -femur schwarz mit grauen Haarschuppen; Tibia gelb, nur an der Basis und am Distalrand schmal schwarz; Sporne und Tarsen gelb.

Vorderflügel: Costalrand hellgelb; Costalrand, Außenrand und Cubitalstamm schwarz; Diskalfleck schwarz, schmal, nur an der Basis der Adern M1—M3 mit wenigen hellgelben Schuppen; Analrand dicht hellgelb bestäubt; die Adern M1—M3 im ETA hellgelb bestäubt; das Apikalfeld schmal, halb so breit wie das ETA, hellgelb, die Adern schwach schwärzlich bestäubt; Fransen sehr lang, grau, dreimal länger als die Breite des schwarzen Außenrandes, ETA in 5 Zellen geteilt, konkav gewölbt, die erste Zelle zwischen R3 und dem Aderstiel R4—R5 extrem verkürzt. Unterseite ähnlich gefärbt, nur der Costalrand dicht weißgelb bestäubt.

Hinterflügel: durchsichtig; die Adern und der schmale Rand schwarz; Fransen sehr lang, grau; der Diskalfleck schwarz, sehr schmal, keilförmig, erreicht jedoch den gemeinsamen Stiel der Adern M3—Cu1.

Abdomen: schwarz; das zweite Tergit distal breit hellgelb begrenzt; das vierte in der Distalhälfte hellgelb; fünftes Tergit mediodorsal mit gelbem Fleck, sechstes und siebtes Tergit fast ganz hellgelb; der Analbusch rundlich, medial und lateral hellgelb, sonst schwarz. Das zweite Sternit am Distalrand breit gelb beschuppt, das dritte schwarz, Sternite 4—7 mit Ausnahme der schmalen proximalen Ränder hellgelb; Analbusch schwarz, mit gelben Schuppen durchmischt, medial und lateral an der Basis gelb; Valven hellgelb beschuppt.

Weibchen. Unbekannt.

Variabilität. Bei den 5 bisher bekannten Exemplaren unbedeutend.

Genitalapparat ♂ (Abb. 10). Valve mittelbreit, dorsal gleichmäßig konkav gewölbt, Apex stumpf, die kahle Fläche relativ klein, dorsal einfach konkav gewölbt, Crista sacculi schmal, gerade, an der Dorsalkante bis zur Mitte mit kräftigen, stark sklerotisierten Borsten, subapikal

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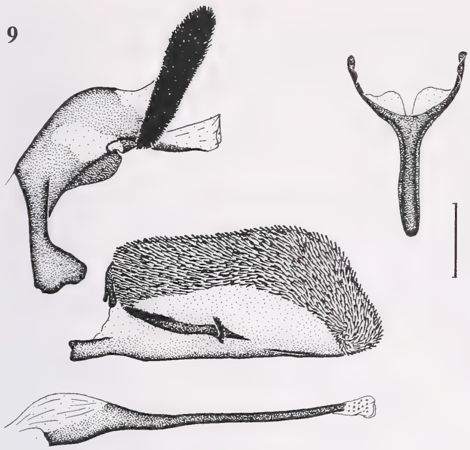

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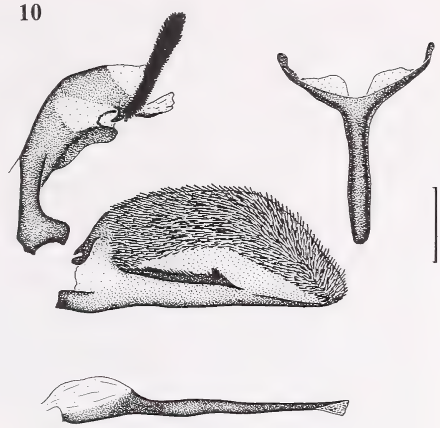

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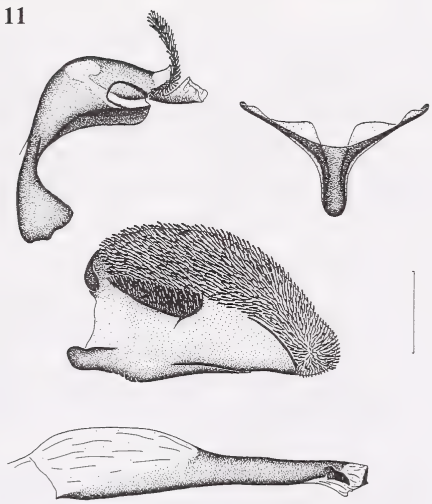

Abb. 9—11: Genitalpräparate. — Abb. 9: *Bembecia pashtuna* sp. n., Paratypus ♂. Pakistan, Baluchistan, 7 km O Ziarat, ca 150 km N Quetta, 2500—2700 m, ex. p. 15. 6. 1992, leg. K. Špatenka (Gen.präp. O. Gorbunov 93—03). — Abb. 10: *Bembecia aloisi* sp. n., Paratypus ♂. Pakistan, Baluchistan, Ziarat-Paß 9 km O Ziarat, 2700 m, ex pupa 23. 6. 1992, leg. K. Špatenka (Gen.präp. O. Gorbunov 93—02). — Abb. 11: *Chamaesphecia weidenhofferi* sp. n., Paratypus ♂. Uzbekistan, 20 km SW Guzar, Gumbulak, 38.30° N, 66.21° O, 750 m, 25. 5. 1995, leg. K. Špatenka (Gen.präp. O. Gorbunov 95—12). Maßstäbe: 0.5 mm.

noch eine kleine Gruppe gleicher Borsten (Seten), Apex der Crista sacculi zugespitzt; Gnathos einfach, mit schmalen bumerangförmigen Lateralkanten; Crista medialis schwach entwickelt.

Differentialdiagnose. Habituell ähnelt diese neue Art mehreren anderen Arten der Gattung, so z. B. *B. puella*, *B. zebo*, *B. zuvandica*, *B. parthica*, teilweise auch *B. sirphiformis* und *B. flavida*. Von diesen unterscheidet sie sich aber in der Genitalmorphologie. *B. aloisi* sp. n. gehört demzufolge in die „*ichneumoniformis*"-Gruppe (Gnathos und Crista sacculi einfach), während die übrigen ähnlichen Arten der „*uroceriformis*"-Gruppe (doppelte Gnathos), „*scopigera*"-Gruppe (gespaltene Crista sacculi) oder „*megillaeformis*"-Gruppe (doppelte Crista sacculi) zuzuorden sind.

Von den zentralasiatischen Arten steht *B. zebo* aus Tadzhikistan der neuen Art äußerlich am nächsten. Diese lebt ebenfalls als Raupe in *Onobrychis*, gehört genitalmorphologisch jedoch in die „*scopigera*"-Gruppe. Aber auch habituell unterscheidet sich *B. zebo* in einigen Details: die gelb gefärbten Körperteile sind ockergelb statt blaßgelb, die Patagia schwarz (bei *B. aloisi* sp. n. lateral hellgelb); der Diskalfleck des Vorderflügels breit (bei *B. aloisi* sp. n. schmal); das PTA im apikalen Drittel ockergelb (bei *B. aloisi* sp. n. unbeschuppt).

Bionomie. Die Raupe hat offenbar eine einjährige Entwicklung und lebt in der Wurzel der polsterbildenden *Onobrychis dealbata* (Fabaceae). Das Auffinden der Raupe in den dicken holzigen Wurzeln der stark dornigen, auf den Lokalitäten häufig vorkommenden Pflanze ist extrem mühsam. Wir konnten trotz großer Mühe in 5 Tagen nur eine Raupe und eine Puppe finden. Die Imagines sind im Freiland wahrscheinlich in der zweiten Junihälfte und im Juli zu finden. Ähnlich wie bei anderen Arten der Gattung *Bembecia* fällt ihre sexuelle Aktivität in die Vormittagsstunden.

Habitat. Trockene Abhänge auf felsigem Grund und Felsen im Ziarat-Tal und auf dem Ziarat-Paß in Höhen von 2600 bis 2700 m, wo die Futterpflanze ein dominierender Vertreter der perennierenden Vegetation ist. *Onobrychis dealbata* bildet hier, ähnlich wie *O. cornuta* in Transkaukasien oder wie *O. echidna* in der Turkestan-Kette, Polsterfluren.

Derivatio nominis. Die Art ist nach meinem Freund und Begleiter auf der Pakistan-Expedition, Dipl.-Ing. Alois Pavlíčko benannt, der mir beim Suchen nach Glasflüglern in Baluchistan und Kohistan sehr geholfen hat.

Chamaesphecia mudjahida sp. n. (Abb. 6)

Material. Holotypus ♂, Afghanistan, Nuristan: Bashgal, Menalgal, Dandizenor Mts. 2200–3000 m, 27.–29. 5. 1972, C. M. Naumann leg., Coll.-Nr. 1217 (coll. ZFMK).

Beschreibung. Spannweite 20 mm. Kopf: Labialpalpus dorsal braun, auf dem ersten und zweiten Glied mit weißlichen Schuppen, auf der Innen- und Ventral-Seite zitronengelb; Antenne braun, nur ventral am Pedicellus mit einigen gelben Schuppen; Stirn braun; Scheitel schwarz; Halskrause hellgelb.

Thorax: schwarzbraun, lateral unter dem Vorderflügel mit gelbem Fleck; mit kleinem weißgelbem Scapularfleck; Tegulae an der Flügelbasis mit einer Gruppe haarförmiger gelber Schuppen. Vorderbein braun; Dorsalkante von Coxa, Femur und Tibia ventralwärts und die Distalenden der Tarsen hellgelb; Hinterbein braun; Tibia zitronengelb mit braunem Ring; Sporne hellgelb.

Vorderflügel: schmal und lang, braun, mit kleinen Glasfeldern; im Vorderflügelapex zwischen den Adern R4–R5 und R5–M1 ein kleiner blaßgelber Fleck; die Adern im ETA blaßgelb; PTA sehr kurz; Keilfeldchen auf ca. die Hälfte verkürzt; ETA oval, halb so breit wie das braune Apikalfeld, durch die Adern in drei Zellen geteilt. Der ventrale Costalrand, der Analrand, der Cubitalstamm, die Ränder des Diskalflecks und das Apikalfeld im Apex reich blaßgelb bestäubt.

Hinterflügel: unbeschuppt, mit braunen Adern, schmalem Außenrand, langen braunen Fransen und kurzem, breit keilförmigem, braunem Diskalfleck.

Abdomen: braunschwarz; Hinterrand von Tergit 2 schmal zitronengelb bestäubt; Tergit 4 zitronengelb; 6 am Hinterrand und 7 auf der gesamten Fläche zitronengelb bestäubt, wenn auch nicht dicht; Analbusch schmal, hellgelb, nur lateral mit einzelnen braunen Schuppen. Die Sternite 2, 4, 6 und 7 fast ganz hellgelb; das dritte Sternit mit schmalem, das fünfte mit breitem gelbem Distalrand.

Variabilität. Unbekannt.

Genitalapparat. Nicht untersucht.

Differentialdiagnose. *Ch. mudjahida* sp. n. ist wahrscheinlich mit *Ch. minor* (Staudinger, 1856), *Ch. pechi* (Staudinger, 1887) und *Ch. masariformis* (Ochsenheimer, 1808) nahe verwandt, unterscheidet sich aber habituell in vielen Merkmalen. Schon auf den ersten Blick ist bei *Ch. mudjahida* sp. n. die schmale und relativ lange Form der Flügel auffallend. Das ETA ist klein und sein Innenrand konkav gewölbt. Die oben genannten Arten haben kürzere und breitere Flügel und das ETA ist größer mit geradem Innenrand. Eine ähnliche Flügelform weisen die Vertreter der Untergattung *Chamaesphecia* (Typusart: *Sphinx empiformis* [Denis & Schiffermüller], 1775) auf, keine dieser Arten (mit Ausnahme der *Ch. bibioniformis* (Esper, 1800) hat freilich den hellen Scapularfleck. Aus dieser Gruppe ähnelt der neuen Art, gerade durch die Flügelform, die auch aus Afghanistan bekannte *Ch. mutilata* (Staudinger, 1887). Sie unterscheidet sich aber unter anderem durch die oben genannten Merkmale, durch den ganz schwarzen Kopf und die roten Ringe auf dem Abdomen.

Bionomie und Habitat. Unbekannt.

Derivatio nominis. Die Art ist den afghanischen Unabhängigkeitskämpfern, den Mudjahedin, gewidmet.

Chamaesphecia weidenhofferi sp. n. (Abb. 7, 8)

Material. Holotypus ♂, Uzbekistan, 20 km SW Guzar, Gumbulak, 38.30° N, 66.21° O, 750 m, 3. 6. 1995, K. Špatenka leg., coll. Museum Witt, München; Paratypen: 1 ♀, Uzbekistan, Malguzar Gebirge, Badbad, 39.54° N, 67.15° O, 900 m, 9. 6. 1995, K. Špatenka leg. et coll.; 14 ♂♂, 5 ♀♀ mit gleichen Daten wie der Holotypus, 2 ♀ Paratypen wie Holotypus, aber 28. 5. 1995, K. Špatenka leg. et coll. (davon 1 ♀ genitaluntersucht). Paratypen in den Sammlungen K. Špatenka (Praha), Museum Witt (München) und O. Gorbunov (Moskau).

Männchen. Holotypus ♂: Spannweite 21 mm; eine mittelgroße rotgelbe Art. Kopf: Labialpalpus dorsal hell ockergelb, ventrolateral auf dem ersten und zweiten Glied mit langen, ockergelben und schwarzen Haarschuppen; Stirn glänzend grau, vor dem Auge mit gelbweißem Saum; Scheitel schwarz, mit dichten, hell ockergelben Haarschuppen; Halskrause hell ockergelb, lateral weißlich; Antennen schwarz, dicht hell ockergelb überstäubt.

Thorax: grau mit starkem grünlichem Glanz, lateral unter dem Vorderflügel mit mehlweißem Fleck; Innenrand der Tegulae mehlweiß, Meso- und Metathorax distal mehlweiß beschuppt. Vorderbein: Coxa schwarz, Dorsalkante mehlweiß beschuppt, Femur, Tibia und Tarsus mehlweiß. Hinterbein: Coxa und Femur schwarz mit grün-metallischem Glanz, Femur distal mit mehlweißen Schuppen, Tibia schwarzbraun, bei den schmutzigweißen Spornen mit breiten mehlweißen Bändern, Tarsus mehlweiß, nur am Basalglied mit einzelnen dunkelbraunen Schuppen.

Vorderflügel: Costalrand schwarz mit grünem Glanz; Costalkante mehlweiß, zwischen den Costaladern mehlweiße Schuppen; Außenrand schmal, braunschwarz beschuppt; Analrand hell ockergelb; alle Glasfelder dicht beschuppt mit hell ockergelben Schuppen, nur zwischen den Medialadern drei durchscheinende, kurze und schmale, mit weißen Schuppen bedeckte Strahlen; Apikalfeld und Adern hell ockergelb; Fransen dreimal so lang wie die Breite des Außenrandes, braun mit mehlweißen Enden.

Hinterflügel: durchsichtig, mit braunschwarzem, schmalem Außenrand, mit schwarzen Adern und schwarzem, breit keilförmigem Diskalfleck, der den Aderstiel M3—Cu1 erreicht.

Abdomen: grauschwarz, mit grünem Glanz, das zweite und fünfte Tergit mit schmalem mehlweißem Hinterrand, das dritte Tergit medial am Hinterrand mit mehlweißem Fleck, die Tergite 4, 6 und 7 fast ganz mehlweiß; Analbusch schwarz, sublateral mit zwei breiten Strahlen mehlweißer Haarschuppen; lateral: auf dem zweiten Tergit mit einigen mehlweißen Schuppen, die Tergite 3—7 mit je einem großen mehlweißen Fleck; Sternite 3—7 grau, mit weißen Schuppen auf den Hinterrändern, auf dem dritten Sternit nur sehr wenigen.

Weibchen. Spannweite 25 mm, robuster, Labialpalpus mehlweiß; Stirn weißlich; Scheitel rostgelb; Innenseite der Tegulae breit ockergelb gerandet; Thorax mit unzusammenhängender ockergelber Mediallinie; Vorderflügel ockergelb mit zahlreichen orangegelben Schuppen am Analrand und im Apikalfeld; die Adern im ETA und im Apikalfeld mit verstreuten schwarzen Schuppen. Die hellen Partien des Vorderflügels ventral mehlweiß. Abdomen dick, das erste Tergit am Hinterrand mit einzelnen, hell ockergelben Schuppen, drittes Tergit medial am Hinterrand mit hell ockergelbem Fleck, Hinterränder der Tergite 2, 4—6 mit breiten, hell ockergelben Ringen. Sternite 4—7 mit schmalen mehlweißen Ringen.

Variabilität. Wenig ausgeprägt, die Grundfärbung des Vorderflügels ist bei einigen Männchen mehlweiß statt hell ockergelb, bei einigen Weibchen hell ziegelrot statt ockergelb; bei einem Weibchen ist das Abdomen dorsal fast ganz mehlweiß bestäubt.

Genitalapparat ♂ (Abb. 11). Ähnlich den naheverwandten, ebenfalls in *Phlomis* spp. lebenden Arten *Ch. ferganae* Sheljuzhko, 1924, und *Ch. zimmermanni* (Lederer, 1872). Valve kurz, ebenso die Crista sacculi, am Ventralrand fehlt die Borstengruppe; Saccus kurz, breit, am Ende abgerundet; Aedeagus kurz, breit und gerade; Scopula gut entwickelt; Gnathos ohne Crista medialis, mit sehr schmalen Lateralkanten.

Differentialdiagnose. *Ch. weidenhofferi* sp. n. ist nahe verwandt mit *Ch. zimmermanni* und *Ch. ferganae* und ähnelt beiden Arten. *Ch. zimmermanni* ist u. a. schlanker, hat schmalere Flügel, schwarze Antennen, gut entwickelte Glasfelder, vollständig ockergelbe Hinterbeine. Das Abdomen ist ventral vollständig hell ockergelb und besitzt dorsal nur auf den Tergiten 2, 4, 6—7 (♂) oder 2, 4, 6 (♀) gleichfarbige Ringe. Die ebenfalls verwandte *Ch. ferganae* hat teilweise braunschwarz beschuppte Hinterflügel, und das Abdomen trägt nur einen weißlichen Ring. Eine weitere, nahe verwandte Art *Ch. margiana* (Püngeler, 1912) hat rote Vorderflügel und ein Abdomen mit sehr schmalen weißen Ringen.

Bionomie und Habitat. Die Raupe ist offensichtlich einjährig und lebt in den Wurzeln von *Phlomis betonicifolia* (Lamiaceae). Sie verpuppt sich in einer Kammer im Wurzelhals. Die Flugzeit der Imagines liegt offensichtlich zwischen Mitte Mai und Mitte Juni. Sie sind in den Vormittagsstunden sexuell aktiv. Sie fliegen nur bei Sonnenschein sehr schnell nahe über dem Boden und setzen sich auf die Blätter der Futterpflanze oder auf deren rote Blüten, an denen sie auch saugen.

Die Futterpflanze und wahrscheinlich auch diese neue Glasflügler-Art sind auf Hügeln mit sehr spärlicher Halbwüstenvegetation und auf steinigen, trockenen Weideplätzen in Höhen von 500 bis 1000 m über NN weit verbreitet. Auf solchen Plätzen stellt *P. betonicifolia* die einzige höhere Pflanze dar und bildet mehrere Quadratkilometer große Bestände. Solche umfangreichen Biotope wurden westlich von Sherabad (südwestlichstes Uzbekistan) und in niedrigeren Lagen des Kugitangtau-Gebirges beobachtet, ferner nördlich von Sairob, westlich vom Akrabat-Paß (Tjubere-Oland-Kette), überall in den Hügeln zwischen Dekhanabad und Guzar und im Malguzar-Gebirge nördlich von Samarkand.

Derivatio nominis. Die neue Art trägt den Namen meines Freundes, des Lycaenidologen Dipl.-Ing. Zdĕnek Weidenhoffer (Prag), der mich in den letzten zehn Jahren auf allen Expeditionen begleitet und beim Suchen von Glasflüglern sehr unterstützt hat.

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Ich danke Herrn Prof. Dr. D. Podlech (Botanische Staatssammlung München) sehr für die Bestimmung der pakistanischen Futterpflanzen und Herrn Prof. Dr. C. M. Naumann (ZFMK, Bonn) für die leihweise Überlassung des Exemplars von *Ch. mudjahida*. Dr. O. Gorbunov (Moskau) fertigte die Illustrationen der Genitalpräparate an, wofür ich ihm zu besonderem Dank verpflichtet bin. Herrn A. Kallies (Greifswald), Herrn Prof. Dr. C. M. Naumann und Herrn Dr. D. Stüning (beide ZFMK, Bonn) danke ich für ihre Unterstützung bei der Vorbereitung des Manuskriptes.

Zusammenfassung

Es werden fünf neue Sesiiden-Arten aus Zentralasien beschrieben. *Bembecia pashtuna* sp. nov. aus Pakistan, Baluchistan, ist mit *B. dispar* und *B. tsvetajevi* verwandt; die Raupe lebt in *Astragalus lacei*. *B. aloisi* sp. nov., ebenfalls aus Baluchistan, lebt in *Onobrychis dealbata*. Sie gehört zur *B. ichneumoniformis*-Gruppe und ähnelt *B. zebo*. *B. karategina* sp. nov. wurde in einem Pärchen in Tadzhikistan gefangen und ähnelt ebenfalls *B. zebo*; ihre Larvalbionomie ist noch unbekannt; *Chamaesphecia mudjahida* sp. nov. ist bisher nur nach einem Stück aus Afghanistan (Nuristan) bekannt. Sie ähnelt durch die Flügelform *Ch. mutilata*, ist aber eher mit *Ch. masariformis* verwandt. Auch ihre Larvalbionomie ist unbekannt. *Ch. weidenhofferi* sp. nov. wurde in SW-Uzbekistan entdeckt. Sie ist mit *Ch. zimmermanni* und *Ch. ferganae* verwandt. Die Raupe lebt in *Phlomis betonicifolia*.

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Neue Glasflügler-Arten und Unterarten aus Europa und der Türkei (Sesiidae, Lepidoptera)

K. Špatenka

Abstract. Nine new species and subspecies of clearwing moths (Sesiidae) are described from Europe and Turkey. Many specimens of *Bembecia peterseni* sp. n. have been collected from a number of localities in Anatolia (Turkey). It resembles a number of *Bembecia* species and is closely related to *B. iberica* from France, Spain and Morocco. *Synanthedon hera* sp. n. described from several specimens from the Taurus (Turkey) is closely related to *S. mannii. Dipchasphecia intermedia* sp. n. was collected and bred from specimens originating from the Pontus and Taurus Mts (Turkey). It resembles *D. lanipes* and *D. krocha* its larva living in *Acantholimon* sp. *Chamaesphaecia kautti* from Niğde (Turkey), closely related to *Ch. bibioniformis. Chamaesphecia taurica* sp. n. also belongs into the same group. *Synanthedon stomoxiformis riefenstahli* ssp. n. from southern Spain, *Synanthedon andrenaeformis tenuicingulata* ssp. n. from north-eastern Turkey and from Armenia, *Bembecia pavicevici dobrovskyi* ssp. n. from the Taygetos Mts (Greece), and *Bembecia syzcjovi kappadocica* ssp. n. from Kappadokia (Asia Minor) represent new subspecies of species already known from other parts of the Palaearctic region.

Key words. Sesiidae, clearwing moths, systematics, Europe, Turkey.

Mit dieser Arbeit wird eine Reihe von Beschreibungen neu entdeckter Glasflügler-Arten fortgesetzt. Besonders in den letzten ca. 10 Jahren vermehrte sich die Anzahl der Anhänger dieser bemerkenswerten Schmetterlingsgruppe in ganz Europa, besonders aber in Deutschland. Diese Tatsache ist sicher mit der leichteren Zugänglichkeit synthetischer weiblicher Sexualpheromone verbunden, die auch den Entomologen, die bisher nie im Leben einen Glasflügler gesehen haben, umfangreichere Ausbeuten ermöglicht. Als Folge dieser intensiven Sammelaktivität wurden viele neue Arten entdeckt. Leider führt dies aber auch dazu, daß dem Studium der Bionomie der Arten weniger Aufmerksamkeit gewidmet wird.

Synanthedon stomoxiformis riefenstahli ssp. n. (Abb. 1)

Material. Holotypus ♂, Spanien, Provinz Alicante, Orcheta, 500 m, 18.—22. 5. 1993, H. Riefenstahl leg., coll. Museum Witt, München[1]; Paratypen: 1 ♂ mit gleichen Daten, 4 ♂, 1 ♀, Spanien, Provinz Alicante, Relleu, 21.—23. 5. 1993, H. Riefenstahl leg. et coll.

Differentialdiagnose. Spannweite 28 mm. Von der Nominatform wie folgt unterschieden: Apikalfeld sehr breit, breiter als das Rundfeldchen (ETA) (sehr reduziert in der Nominatform), schwarzbraun; Diskalfleck des Hinterflügels wesentlich breiter; die Beine schwarz mit grünviolettem Glanz (Tarsen bei der Nominatform hellbraun); Thorax vollkommen schwarz (Innenrand der Tegula bei der Nominatform rot).

Eine ähnliche Unterart ist aus Kleinasien und Transkaukasien bekannt: *S. s. amasina* (Staudinger, 1856). Bei dieser Unterart ist die Tegula breit rot begrenzt, und nur die Abdominalsternite 4 und teilweise 5 sind rot, bei *S. s. riefenstahli* ssp. n. und *S. s. stomoxiformis* (Hübner,

[1] Die umfangreichen Sammlungen des Museums Witt in München werden zu gegebener Zeit an die zoologische Staatssammlung in München transferiert.

1790) sind die Sternite 4—7 rot. Die Raupe der Subspecies *amasina* lebt in den Wurzeln von *Rhamnus palasi* (Rhamnaceae).

Bionomie und Habitat. Die Raupe ist wahrscheinlich zweijährig und lebt nach den Angaben des Entdeckers in den Wurzeln von *Rhamnus cathartica* (Rhamnaceae) und *Crataegus* sp. (Rosaceae).

Verbreitung. Bisher nur von der Typenlokalität bekannt.

Derivatio nominis. Die neue Unterart ist ihrem Entdecker gewidmet.

Synanthedon andrenaeformis tenuicingulata ssp. n. (Abb. 2)

Material. Holotypus ♂, Türkei, Avcı Dağları, Girlevik, 39.35° N, 39.44° O, 17. 6. 1993, T. Dobrovský leg., coll. Museum Witt, München; Paratypen: 1 ♂, 1 ♀ dito, VI. 1993 ex pupa, T. Dobrovský leg. et coll., 1 ♂ Türkei, Provinz Kars, Sarikamiş, 2000 m, 21.—23. 7. 1992, A. Kallies leg. et coll.

Männchen. Spannweite 20 mm. Antenne schwarz; Labialpalpus schwarz, unten ockergelb; Kopf und Thorax schwarz; der Vorderflügel mit gut entwickelten Glasfeldern; ETA breiter als das schwarze Apikalfeld, außen konkav gewölbt; der breite Diskalfleck, die Adern und Ränder schwarz. Ventral: Apikalfeld dunkel; der Vorder- und Hinterrand mit hellen, schmutziggelben Schuppen bestäubt. Hinterflügel durchsichtig mit breitem, keilförmigem schwarzem Diskalfleck und schwarzem Außenrand; Adern, Fransen und Beine schwarz, nur die Tarsen dorsal mit verstreuten ockergelben Schuppen, ventral ockergelb. Abdomen schwarz mit sehr schmalen, hell ockergelben Ringen auf den Tergiten 2 und 4, lateral schwarz mit hell ockergelben Flecken auf den Tergiten 1 und 2, ventral schwarz mit schmutziggelben Sterniten 4—6; Analbusch schwarz, Valven dunkel ockergelb bestäubt.

Weibchen. Ähnelt sehr dem Männchen; ETA schmäler, Diskalfleck des Vorderflügels noch breiter und Beine dunkler; auf dem Abdomen ist nur die Distalhälfte von Sternit 4 schmutzigweiß.

Differentialdiagnose. Die neue Unterart unterscheidet sich in mehreren Merkmalen von der Nominatform: ETA breiter und außen konkav gewölbt (bei der Nominatform sehr schmal und trapezförmig mit geradem oder leicht konvexem Außenrand); Apikalfeld schwarz (bei der Nominatform stets mit mehr oder weniger ausgeprägten hellen Strahlen zwischen den Adern); Diskalflecke auf beiden Flügeln wesentlich breiter als bei der Nominatform; auch die Beine

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Abb. 1—10: Imagines der neuen Glasflügler (Belege in Coll. Museum Witt, München). — Abb. 1: *Synanthedon stomoxiformis riefenstahli* ssp. n., Holotypus ♂. Spanien, Provinz Alicante, Orcheta 500 m, 18.—22. 5. 1993, H. Riefenstahl leg. — Abb. 2: *Synanthedon andrenaeformis tenuicingulata* ssp. n., Holotypus ♂. Türkei, Avcı Dağları, Girlevik, 39.35 °N, 39.44 °O, 17. 6. 1993, T. Dobrovský leg. — Abb. 3: *Bembecia peterseni* sp. n., Holotypus ♂. Türkei, Niğde, Ala-Dağ, Demirkazik, 1800 m, 4. 8. 1991, P. Kautt leg. — Abb. 4: *Bembecia pavicevici dobrovskyi* ssp. n., Holotypus ♂. Griechenland, Peloponnes, Taygetos Gebirge, Kardamili, 36.31 °N, 23.17 °O, 15. 7. 1992, T. Dobrovský leg. — Abb. 5: *Bembecia syzcjovi kappadocica* ssp. n., Holotypus ♂. Türkei, Kappadokien, Yeşilöz, 1300 m, larva 7. 6. 1993, ex. l. Ende August 1993, K. Špatenka leg. — Abb. 6: *Bembecia syzcjovi kappadocica* ssp. n., Paratypus ♀. Türkei, Kappadokien, Yeşilöz, 1300 m, larva 7. 6. 1993, ex. l. Ende August 1993, K. Špatenka leg. — Abb. 7: *Synansphecia hera* sp. n., Holotypus ♂. Türkei, Osttaurus, 1 km S Pürem Paß (N von Kahramanmaraş), 37.58 °N, 36.35 °O, 1500 m, 30. 6.—1. 7. 1991, K. Špatenka leg. — Abb. 8: *Dipchasphecia intermedia* sp. n., Holotypus ♂. Türkei, Taurus-Gebirge, 10 km N Saimbeyli (Hadjin), 1450 m, 36.07.12 °O, 38.03.12 °N, 6. 6. 1993 ex larva ex *Acantholimon* sp., K. Špatenka leg. — Abb. 9: *Chamaesphecia kautti* sp. n., Holotypus ♂. Türkei, Niğde, Ala Dağ, Demirkazik, 25.—26. 7. 1991, 1600 m, P. Kautt leg. — Abb. 10: *Chamaesphecia taurica* sp. n., Holotypus ♂. Türkei, Südanatolien, Taurus-Gebirge, Çamlıyayla (Namrun), 1200 m, 37.11 °N, 34.39 °O, 26.—27. 7. 1991, K. Špatenka leg.

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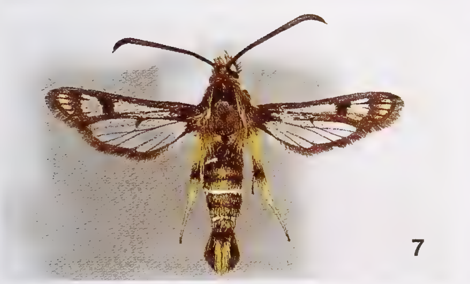

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und das Abdomen sind dunkler; Analbusch schwarz, ohne die für die Nominatform typischen gelben Schuppen; der gelbe Ring auf Tergit 4 ist vergleichbar schmal wie auf Tergit 2 (bei der Nominatform stets deutlich breiter, besonders beim Weibchen); Sternite 4—6 (bei Weibchen nur 4) sind schmutzigweiß (nicht rein weiß wie bei der Nominatform).

Larvalbionomie. Wie bei der Nominatform; die Raupe lebt zweijährig in den Stämmen und Ästen von *Viburnum lantana* (Caprifoliaceae) in lichten Wäldern.

Verbreitung. Bisher nur aus Ostanatolien bekannt (Umgebung von Erzincan und Kars) und aus Armenien (Naturschutzgebiet Chosrov bei Vedi). Das Areal umfaßt wahrscheinlich die ganze Osttürkei und das südliche Transkaukasien. Unklar bleibt die Frage der Existenz einer Kontaktzone zwischen den beiden bisher bekannten Unterarten. Die Südostgrenze der Verbreitung der Nominatform ist wenig bekannt, die südöstlichsten Lokalitäten liegen bei Sofia (Bulgarien) und in Südrußland (Kasan, Simbirsk, Ufa, Orenburg, Samara, Saratow, Sarepta, Uralsk). Bartel (1902) führt auch Kleinasien an, ohne daß hierfür Belegmaterial nachweisbar ist.

Derivatio nominis. Die Benennung erfolgt aufgrund der besonders schmalen Abdominalcingulation.

Bembecia peterseni sp. n. (Abb. 3)

Material. Holotypus ♂, Türkei, Niğde, Ala-Dağ, Demirkazik, 1800 m, 4. 8. 1991, P. Kautt leg., coll. Museum Witt, München; Paratypen: 7 ♂♂ mit gleichen Daten; 8 ♂♂ gleiche Angaben, 25.—26. 7. 1991; 3 ♂♂, Türkei, Kappadokien, Göreme, 7. 8. 1991; 1 ♂, Türkei, Adana, Saimbeyli, 1400 m, 10. 8. 1991; 5 ♂♂, Türkei, Bingöl/Muş, Buğlan-Paß, 1600 m, alle P. Kautt leg., coll. Museum Witt, München; 1 ♂ Türkei, Prov. Tunceli, 15 km N Tunceli, 13.—14. 7. 1992, M. Petersen leg., coll. K. Špatenka (GU Nr. 83-393 E. Blum); 1 ♂ mit gleichen Daten in coll. Kallies; 8 ♂♂ Türkei, Kappadokien, Göreme, 24. 6. 1992, H. Riefenstahl leg. et coll.; 1 ♂ Türkei, Provinz Malatya, Kale, 700 m, 12. 7. 1992, A. Kallies leg. et coll., 1 ♂ ♀ Türkei, C Taurus, Sartauul gec. 1650 m, 36.55° N, 33.16.25° E, 22.—23. 7. 1996, K. Špatenka leg. et coll.; 3 ♂ Türkei, Prov. Erzurum, Karagöbek, 1970 m, 40.10.40° N, 41.26° E, 17. 7. 1996, K. Špatenka leg. et coll., 1 ♂ Türkei, Prov. Agri, Arasgünei Dgl, Tahir, 2250 m, 39.51° N, 42.25.40° E, 14. 7. 1996, K. Špatenka leg. et coll., 13 ♂ Türkei, Prov. Kars, Kargapazari Dgl., Tasoluk, 1700 m, 40.16° N, 41.35.40° E, 14.—15. 7. 1996, K. Špatenka leg. et coll.

Männchen. Spannweite 16—22 mm. Eine schlanke Art mit relativ schmalen Vorderflügeln. Labialpalpus weißgelb, lateral außen schwarz; Antenne schwarz- braun, subapikal heller, ventral braun; Stirn weißgelb; Scheitel schwarz mit ockergelben Haaren; Halskragen ockergelb.

Thorax: schwarz; Patagia lateral ockergelb; Scapularfleck weißgelb; Innenrand der Tegula ockergelb; Metathorax distal zitronengelb. Vorderbein schwarz, -coxa dorsal in ganzer Länge hellgelb, -femur schwarz, ventral hellgelb, -tibia hellgelb, basal und apikal mit schwarzen Punkten, Tarsus hellgelb; Hinterbein: Coxa und Femur schwarz mit langen gelben Haaren, Tibia basal und apikal mit schwarzen Ringen, sonst hellgelb, Tarsus hellgelb mit vereinzelten schwarzen Schuppen, ventral mit schwarzen Dornen.

Vorderflügel: ockergelb mit gut entwickelten Glasfeldern; Costalrand braunschwarz mit hell ockergelben Schuppen zwischen den Adern, Außenrand schmal braunschwarz, Fransen lang braunschwarz, Analrand orangegelb beschuppt, Cubitalstamm braunschwarz, Basalhälfte des Diskalflecks dunkelbraun, Apikalhälfte dunkel ockergelb bis orangegelb, halb so breit wie das Rundfeldchen, Apikalfeld etwa so breit wie das Rundfeldchen, hell ockergelb mit schmal, aber deutlich dunkelbraun beschuppten Adern. Das Keilfeldchen bis zur schwarzen Flügelwurzel reichend, das Längsfeldchen apikal durch die ockergelbe Bestäubung auf etwa 2/3 der Länge reduziert, das Rundfeldchen klein, etwa so hoch wie breit, durch die ockergelb beschuppten Adern in 3 Zellen geteilt, die Räume zwischen den Adern R3—R4, R4—R5, M3—Cu1 und Cu1—Cu2 hell ockergelb beschuppt. Bei frischen Exemplaren sind die Glasfelder mit durchsichtigen, stark perlmuttartig glänzenden Schuppen belegt. Ventral ist auch auch der Costal- und Analrand des Vorderflügels hell ockergelb.

Hinterflügel: durchsichtig mit sehr schmalem dunkelbraunem Außenrand, dunkelbraunen Adern und Fransen und kurzem, breit-keilförmigem Diskalfleck, der zwischen den Adern M2 und dem Aderstiel M3—Cu1 nur aus einer einzigen Schuppenreihe besteht.

Abdomen: schwarz, mit deutlichen, breit zitronengelben Bändern, Hinterrand von Tergit 1 mit undeutlichem gelbem Ring, Tergit 2 in der Distalhälfte gelb, 3 mit schmalem, aber deutlichem gelbem Hinterrand, 4 in der Distalhälfte, 5 in den distalen $^2/_3$, 6 fast ganz und 7 ganz gelb. Die gelben Bänder auf den Tergiten 4—7 tragen an den Distalrändern je eine Reihe weißgelber Schuppen; Analbusch schwarz, medial und lateral zitronengelb. Abdomen lateral ähnlich wie dorsal, ventral schwarz, die Sternite 2—7 mit gleichmäßig breiten weißgelben Distalrändern.

Weibchen. Antenne ockergelb mit schwarzer Spitze; Labialpalpen zitronengelb. Patagialkragen, Innenrand der Tegula und Metathorax breit zitronengelb. Abdomen schwarz, mit sehr breiten zitronengelben Bändern auf den Tergiten 2, 4, 5 und 6, mit breitem, aber kurzem medialen Querband, auch auf dem 3. Tergit, ventral schwarz mit breiten ockergelben Bändern auf den Sterniten 4—6. Vorderrand des Vorderflügels schwarzbraun, lebhaft ockerfarbig bis orange, ebenso wie das Apikalfeld und der Diskalfleck; ETA rundlich, etwa so breit wie das Apikalfeld, in 4 Zellen geteilt, Adern im Apikalfeld schwach braunschwarz beschuppt, Diskalfleck am Innenrand braunschwarz, alle Glasfelder gut entwickelt. Hinterflügel mit sehr kurzem und schmalem, nur bis M2 führendem Diskalfleck. Das Weibchen ähnelt den Weibchen von *B. fibigeri* und *B. albanensis*, unterscheidet sich aber in vielen Details. *B. albanensis* hat z. B. kleinere Glasfelder, alle Abdominalränder sind schmaler (T2—T6), das PTA beschuppt und die Adern im Apikalfeld sind dicht dunkel bestäubt. *B. fibigeri* hat schwarze Antennen mit weißlichem subapikalem Fleck, die Tegula sehr schmal gelb begrenzt, die Abdominalränder 1 und 3 sehr undeutlich, die Hintertibia fast ohne dunkle Schuppen (bei *B. peterseni* mit deutlichem schwarzem distalem Fleck), den Costalrand des Vorderflügels ockergelb, braun bestäubt, die dunklen Adern im Apikalfeld sehr deutlich, den Diskalfleck im Hinterflügel breiter und länger (bis M3—Cul).

Variabilität. Bei einigen, besonders bei leicht abgeflogenen Exemplaren sind die gelben Abdominalbänder schmäler (besonders auf Tergit 3), und der undeutliche gelbe Ring auf Tergit 1 fehlt oft. Bei einigen Exemplaren ist der Diskalfleck des Vorderflügels breiter oder sogar ganz gelb oder orangegelb. Bei Exemplaren mit orangegelbem Diskalfleck ist auch das Apikalfeld orangegelb.

Genitalapparat ♂ (Abb. 11). Individuell sehr variabel, im allgemeinen aber ähnlich dem von *B. iberica* Špatenka, 1992; Valve mittelbreit, mit sehr schmaler bedornter Fläche; Crista sacculi gespalten, ihr dorsaler Processus entweder mächtig wie bei *B. iberica* oder sehr kurz; Gnathos doppelt, mit ovalen oder langgezogenen Lateralkanten, die cranialen lateralen Cristen entweder in einer Höhlung verschmolzen oder proximal stark genähert, jedoch nicht ganz verschmolzen.

Differentialdiagnose. Die neue Art ist phylogenetisch mit *B. iberica* verwandt, ähnelt aber auch weiteren Arten der Gattung *Bembecia*, wie z. B. *B. zuvandica* Gorbunov, 1987, *B. fibigeri* Laštůvka & Laštůvka, 1994, *B. ichneumoniformis* ([Denis & Schiffermüller], 1775), *B. albanensis* (Rebel, 1918) und *B. scopigera* (Scopoli, 1763). *B. ichneumoniformis* und *B. scopigera* unterscheiden sich deutlich durch das große Rundfeldchen (5—6 Zellen), schmale gelbe Abdominalringe und weitere Merkmale. Die genitalmorphologisch verwandte *B. iberica* unterscheidet sich habituell durch den teilweise ziegelroten Diskalfleck, das rostbraune Apikalfeld und den rötlichen Analrand des Vorderflügels. Sie hat auch die Räume zwischen den Adern R3—R4 und Cul—Cu2 schwarz. *B. albanensis* hat bei einigen Exemplaren ähnlich gefärbte Vorderflügel und ähnlich geformte Glasfelder, die Hinterränder der Tergite sind jedoch nur schmal und blaßgelb. *B. zuvandica* ist noch heller gelb, hat den Analrand des Vorderflügels hell ockergelb beschuppt und die medialen Adern im Apikalfeld gelb und nicht schwarz beschuppt. Sie hat auch ein größeres Rundfeldchen, das breiter als das Apikalfeld ist und in 4 statt 3 Zellen geteilt ist. Sehr ähnlich ist auch die spanische und südfranzösische *B. fibigeri*, die nur ein wenig robuster ist, der Farbton der Beine und Abdominalringe ist satter, das Apikalfeld leicht mit schwarzen Schuppen durchmischt und das Rundfeldchen größer (4 Zellen). *B. fibigeri* unterscheidet sich ferner ganz deutlich im Bau des männlichen Genitalapparates, der eine einfache Gnathos und eine ungespaltene Crista sacculi besitzt.

Bionomie und Habitat. Die Raupe ist einjährig und lebt offensichtlich in den Wurzeln einer *Ononis* sp. (Fabaceae), die der mitteleuropäischen *O. spinosa* ähnelt. Sie legt ihre Gänge dicht unter der Rhizodermis an. Vor der Verpuppung baut sie aus miteinander versponnenen Spänen des Wurzelstockes ein manchmal mehrere cm langes Röhrchen. Die Imago schlüpft im Juli und August. Die Art bewohnt trockene Ruderalflächen, z. B. Weideplätze, Straßenränder, Obstgärten und die Umgebung von Bewässerungsanlagen und Brunnen.

Verbreitung. Im mittleren und östlichen Anatolien anscheinend weit verbreitet.

Derivatio nominis. Die neue Art ist Herrn M. Petersen (Pfungstadt), einem ausgezeichneten Sesienkenner, gewidmet.

Bembecia pavicevici dobrovskyi ssp. n. (Abb. 4)

Material. Holotypus ♂, Griechenland, Peloponnes, Taygetos Gebirge, Kardamili, 36.31° N, 23.17° O, 15. 7. 1992, T. Dobrovský leg., coll. Museum Witt, München; Paratypen: 2 ♂♂ dito, 13. 7. 1992; 1 ♂ 15. 7. 1992, alles T. Dobrovský leg. et coll. (Praha); 1 ♂, dito, 12. 7. 1992, Krejčík leg. et coll. (Mladá Boleslav); 1 ♂, Griechenland, Peloponnes, Taygetos, Tseria, 36.53° N, 22.13° O, 14. 7. 1992, T. Dobrovský leg. et coll.; 3 ♂♂, Taygetos, Umg. Saidona, 500 m, 9. 7. 1994, A. Lingenhöle leg., coll. K. Špatenka; 10 ♂♂ mit gleichen Daten, 17. 7. 1995, A. Lingenhöle leg. et coll.; 10 ♂♂, Taygetos, 15 km W Mistras, 400 m, A. Lingenhöle leg. et coll.; 8 ♂♂, Taygetos, Schlucht bei Exohori, 450 m, 22. 7. 1995, A. Lingenhöle leg., coll. K. Špatenka; 30 ♂♂ mit gleichen Daten in coll. A. Lingenhöle.

Männchen. Spannweite 24—27 mm. Das Männchen der neuen Unterart unterscheidet sich in folgenden Merkmalen von *B. p. pavicevici* Toševski, 1989: der schmutzigweiße Fleck auf der Antenne nimmt nur 1/5 der Antennenlänge ein (bei der Nominatform mindestens ein Drittel); die Flügel sind deutlich dunkler bestäubt. Vorderflügel: das Längsfeld (PTA) ist durch die dunkelbraune Bestäubung stark reduziert, der Analrand deutlich breiter, der Diskalfleck dunkelbraun, nur mit dunkel ockergelbem Außenrand (bei der Nominatform ist die äußere Hälfte des Diskalfleckes ockergelb), das Rundfeldchen (ETA) ist sehr klein, 3-zellig, oval, halb so breit wie das Apikalfeld, dicht mit ockergelben und perlmuttartigen Schuppen bestäubt (bei der Nominatform 4—5 zellig, nur 1,5 x schmaler als das Apikalfeld); das Apikalfeld ist dunkelbraun, nur mit 3 kurzen dunkel ockergelben Strahlen zwischen den Adern R5—M1, M1—M2 und M2—M3 (bei *B. p. pavicevici* ist das Apikalfeld vorwiegend ockergelb). Auch der Hinterflügel ist dunkler, mit sehr breitem dunkelbraunem Außenrand, breiter als die Länge der Fransen (bei der Nominatform halb so breit wie die Fransen). Auch der Diskalfleck des

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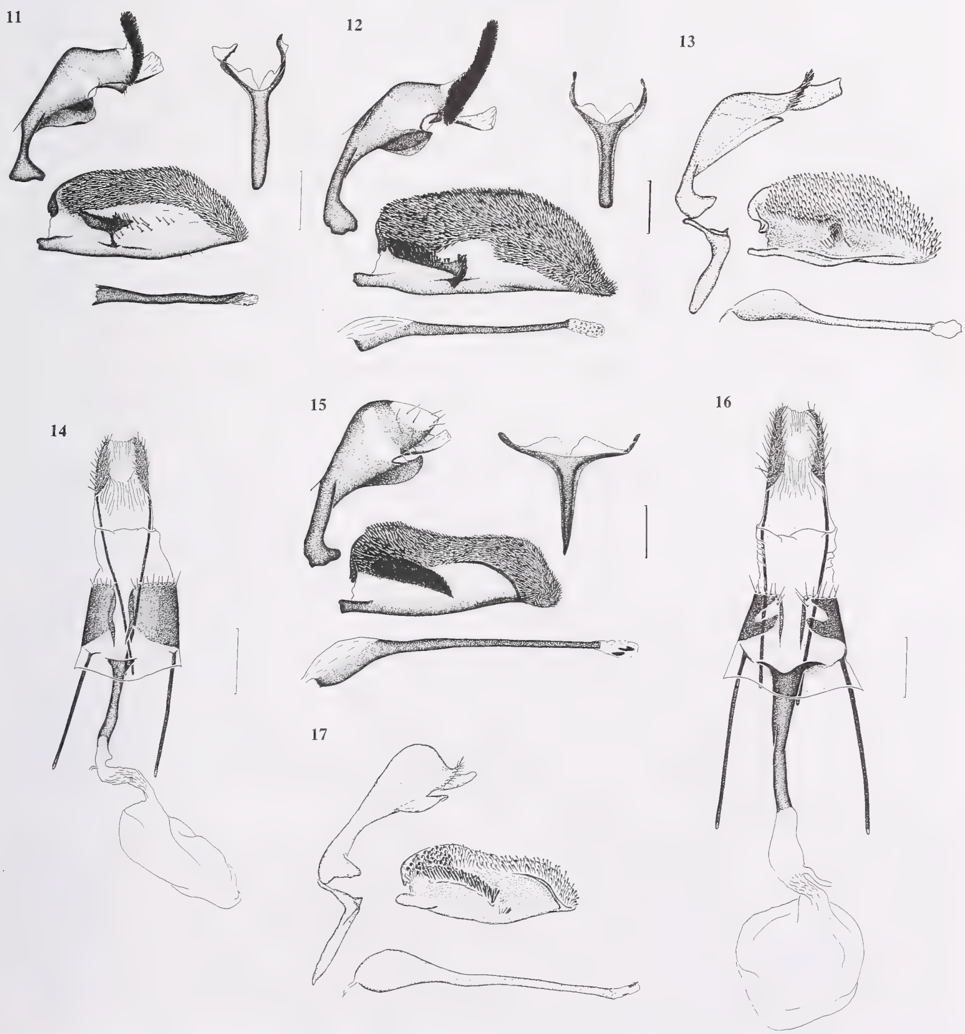
Abb. 11—17: Genitalpräparate. — Abb. 11: *Bembecia peterseni* sp. n., Paratypus ♂. Türkei, Niğde, Ala-Dağ, Demirkazik, 1800 m, 4. 8. 1991, P. Kautt leg. (Gen.präp. O. Gorbunov 95-15). Maßstab: 0.5 mm. — Abb. 12: *Synansphecia hera* sp. n., Paratypus ♂. Türkei, Osttaurus, 1 km S Pürem Paß (N von Kahramanmaraş), 37.58°N, 36.35°O, 1500 m, 30. 6.—1. 7. 1991, K. Špatenka leg. (Gen.präp. O. Gorbunov 93-05). Maßstab: 0.5 mm. — Abb. 13: *Dipchasphecia intermedia* sp. n., Paratypus ♂. Türkei, Taurus-Gebirge, 10 km N Saimbeyli (Hadjin), 1450 m, 36.07.12°O, 38.03.12°N, 6. 6. 1993 ex larva ex *Acantholimon* sp., K. Špatenka leg. (Gen.präp. I. Toševski 822). — Abb. 14: *Dipchasphecia intermedia* sp. n., Paratypus ♀. Türkei, Taurus-Gebirge, 10 km N Saimbeyli (Hadjin), 1450 m, 36.07.12°O, 38.03.12°N, 6. 6. 1993 ex larva ex *Acantholimon* sp., K. Špatenka leg. (coll. Gen.präp. O. Gorbunov 96-03). Maßstab: 0.5 mm. — Abb. 15: *Chamaesphecia kautti* sp. n., Paratypus ♂. Türkei, Niğde, Ala-Dağ, Demirkazik, 25.—26. 7. 1991, 1600 m, P. Kautt leg. (Gen.präp. O. Gorbunov 93-07). Maßstab: 0.5 mm. — Abb. 16: *Chamaesphecia kautti* sp. n., Paratypus ♀. Türkei, Niğde, Ala-Dağ, Demirkazik, 20. 7. 1996, K. Špatenka leg. et coll., 1600 m, (Gen.präp. O. Gorbunov 96-06). Maßstab: 0.5 mm. — Abb. 17: *Chamaesphecia taurica* sp. n., Paratypus ♂. Türkei, Südanatolien, Taurus-Gebirge, Çamlıyayla (Namrun), 1200 m, 37.11°N, 34.39°O, 26. 7. 1991, K. Špatenka leg. (Gen.präp. I. Toševski 762).

Hinterflügels ist kräftiger, breit keilförmig und ohne gelbe Schuppen (bei der Nominatform schwächer, zwischen den Adern M2—M3 sehr schmal und in der Außenhälfte mit hell ockergelben Schuppen).

Weibchen. Spannweite 26—28 mm; ebenfalls dunkler und robuster als die Nominatform; der Analrand des Vorderflügels mehr rötlich; die Antenne vorwiegend gelb, nur an der Basis und der Spitze dunkler; mit breiten zitronengelben Bändern auf den Abdominaltergiten 2—6; der Analbusch mit 2 länglichen gelben Strahlen. Es ähnelt dem Weibchen der Individualform „*kalavrytana*" von *Bembecia albanensis* (Rebel, 1918), unterscheidet sich aber in einigen wichtigen Merkmalen. Der Scheitel ist bei „*kalavrytana*" rostbraun, bei *B. p. dobrovskyi* ssp. n. schwarz mit gelben Haaren; die Glasfelder sind bei „*kalavrytana*" noch stärker reduziert, ETA und PTA fehlen, das ATA ist sehr schmal und kurz. Der Hinterflügel ist bei „*kalavrytana*"



im Apex sehr breit schwarz bestäubt, der Diskalfleck rot und endet auf dem Aderstiel M3—Cu1, bei *B. p. dobrovskyi* ssp. n. hingegen auf der Verzweigung von M3—Cu1.

Kleinere Unterscheidungsmerkmale weisen auch die männlichen Genitalien auf. Die für *B. p. pavicevici* typische kahle subapikale Partie auf der Crista sacculi fehlt bei der neuen Unterart, der ganze Dorsalrand ist hier dicht mit dicken, stark sklerotisierten Seten besetzt. Diese bedecken basal den Ventralrand des mit Seten bestandenen Teiles der Valve (diese Seten fehlen bei *B. p. pavicevici*). Crista sacculi subapikal breit durch eine Reihe dicker Borsten mit der bedornten Fläche der Valve verbunden. Diese Verbindung ist bei *B. p. pavicevici* sehr schwach und wird durch dünnere Borsten gebildet.

Variabilität. Vereinzelt wurden in kühlen Schluchten auch ganz schwarze Exemplare gefangen.

Bionomie und Habitat. Die Larvalbionomie ist unbekannt. Die Raupe lebt offensichtlich, ähnlich wie die von *B. p. pavicevici*, in den Wurzeln von *Coronilla emerus* (Fabaceae). Trockene Waldsteppen und Schluchten in südlichem Taygetos-Gebirge.

Verbreitung. Bisher nur von den südlichen Abhängen des Taygetos-Gebirges bekannt. Die Nominatform ist bisher vom Peloponnes nicht bekannt. Ihr bisher bekanntes Verbreitungsareal zieht sich vom Parnassos-Gebirge in Südgriechenland, über Mazedonien, SW-Bulgarien, die Inseln Korfu und Hvar entlang der dalmatinischen Küste bis nach Istrien und Slowenien. Sie kommt vermutlich auch in Albanien und in NO-Italien vor, von wo Belegmaterial bisher freilich fehlt. Die Art kommt auch auf dem Nord-Peloponnes bei Kalavrita vor (mehrere Exemplare leg. Lingenhöle, 1994). Die Exemplare aus diesem Gebiet unterscheiden sich sowohl von denen aus dem Taygetos als auch von denen vom Festland und von den dalmatinischen Inseln. Die schwarzen Zeichnungen der Flügel sind etwas breiter als bei der Nominatform, der helle Fleck auf der Antenne ist von normaler Breite. Auffallend ist die dichte dunkelockergelbe Bestäubung des Apikalfeldes und des Hinterrandes des Vorderflügels. Mit Schuppen gleicher Farbe sind auch alle Glasfelder des Vorderflügels bestäubt. Die taxonomische Stellung dieser Form bleibt bisher unklar. Ähnliche Merkmale (rotorange bestäubte Glasfelder) weist die aus dem gleichem Gebiet von Sheljuzhko beschriebene Form *kalavrytana* von *B. albanensis* auf.

Derivatio nominis. Die neue Unterart ist nach ihrem Entdecker benannt.

Bembecia syzcjovi kappadocica ssp. n. (Abb. 5, 6)

Material. Holotypus ♂, Türkei, Kappadokien, Yeşilöz, 1300 m, larva 7. 6. 1993, ex l. Ende August 1993, K. Špatenka leg., coll. Museum Witt, München; Paratypen: 4 ♂♂, 3 ♀♀ mit gleichen Angaben, coll. Museum Witt, München; 1 ♂, 1 ♀ mit gleichen Daten in coll. O. Gorbunov; 2 ♂♂ Türkei, Kappadokien, Göreme, 24.—31. 8. 1994, 1000 m, A. Lingenhöle leg., coll. K. Špatenka; 10 ♂♂, 5 ♀♀ gleicher Fundort, 9. 1995, A. Kallies leg. et coll.

Männchen. Spannweite 27 mm. Unterscheidungsmerkmale von der Nominatform: Antenne hellbraun mit schwarzer Spitze (in der Nominatform schwarz); Patagia gelb, nur in der Mitte mit einzelnen schwarzen Schuppen (bei der Nominatform schwarz, nur lateral mit einzelnen gelben Schuppen); der Diskalfleck des Hinterflügels erreicht nicht wie bei der Nominatform den Aderstiel M3—Cu1; der schwarze Fleck auf der Hintertibia undeutlich oder fehlend. Auffallend stärker gelb bestäubt ist das Abdomen: die Tergite 2—3 sind distal breit gelb gerandet und die Tergite 4—7 ganz gelb (bei der Nominatform sind nur die Tergite 4, 6 und 7 gelb, 2 und 5 nur mit sehr schmalen gelben Ringen und 3 ganz schwarz). Sternit 2 ist breit gelb gerandet (bei der Nominatform schwarz).

Weibchen. Sehr vom Männchen verschieden; Antenne, Labialpalpus, Kopf, Thorax und beschuppte Teile der Flügel schwarz; Stirn schmutziggelb; Vordertibia ventral mit braunen Schuppen; Vorderrand des Vorderflügels ventral mit schmutziggelbem Strich; Vorderflügel ähnlich wie beim Männchen mit extrem großen Glasfeldern, Apikalfeld schmal, der Analrand und die Adern freilich schwarz und der Diskalfleck breiter. Hinterflügel unbeschuppt, mit schwarzem Außenrand, Adern und Fransen, der Diskalfleck schwarz, den Aderstiel M3—Cu1 erreichend. Das Abdomen ist schwarz, die Tergite 4—6 mit Ausnahme der schmalen Vorderränder zitronengelb, die hinteren 2/3 der Sternite 4—6 zitronengelb.

Variabilität. Bei einigen Männchen ist die Antenne ganz schwarz, bei einem Weibchen die Abdominaltergite zitronen- und die Sternite orangegelb, bei einem Stück sogar auch die Tergite orangegelb.

Bionomie und Habitat. Die Raupe lebt in der Wurzel einer hochwachsenden, gelbblühenden *Astragalus* sp. (Fabaceae), die bisher noch nicht determiniert werden konnte. Sie ähnelt anderen, ebenfalls von Glasflüglern präferierten *Astragalus*-Arten, wie *A. sieversianus*, *A. trichocalyx*, *A. finitimus*, *A. shahrudensis*, *A. dipsaceus*, *A. lacei* usw. In Kappadokien kommt diese Art sehr lokal unter *A. dipsaceus* auf trockenen steppenartigen Abhängen in schmalen tiefen Tälern vor.

Derivatio nominis. Die neue Unterart wird nach ihrem Fundgebiet Kappadokien benannt.

Synansphecia hera sp. n. (Abb. 7)

Material. Holotypus ♂, Türkei, Osttaurus, 1 km S Pürem Paß (N von Kahramanmaraş), 37.58° N, 36.35° O, 1500 m, 30. 6.—1. 7. 1991, K. Špatenka leg., coll. Museum Witt, München; Paratypen: 1 ♂ mit gleichen Daten, coll. K. Špatenka; 1 ♂, Türkei, Provinz Adana, Taurus-Gebirge, 10 km N Saimbeyli, 38.06° N, 36.08° O, 1450 m, 29. 6. 1991, K. Špatenka leg. et coll. (Genitalpräparat Gorbunov Nr. 93-05) ; 4 ♂♂, Türkei, Konya, 50 km S Beyşehir, Umgebung Bademli, 1300 m, 8. 7. 1992, A. Lingenhöle leg., coll. K. Špatenka, 10 ♂♂ mit gleichen Angaben, A. Lingenhöle leg. et coll., 1 ♂ mit gleichen Angaben A. Kallies coll.; 1 ♂ Türkei, Konya, Beyşehir-See, 20 km W Beyşehir, 7. 7. 1992, A. Lingenhöle leg. und coll.

Männchen. Spannweite 23 mm. Im allgemeinen ähnlich *S. mannii* (Lederer, 1853), im Vergleich zu dieser aber auffallend größer und mit größeren Glasfeldern. Antenne schwarz, außen subapikal mit einzelnen ockergelben Schuppen. Labialpalpus ockergelb, das erste und zweite Glied noch mit weißen Schuppen bestäubt, außen schwarz, mit langen haarförmigen Schuppen; Stirn schneeweiß; Scheitel schwarz mit langen gelbgrauen Haaren; Halskragen ockergelb.

Thorax: schwarz, Tegula innen mit blaßgelben Haaren und einzelnen Schuppen begrenzt; Pleura ockergelb. Beine: Vordercoxa schwarz, dicht mit ockergelben haarförmigen Schuppen überstäubt, so daß die Grundfärbung kaum sichtbar ist; Vorderfemur und -tibia ockergelb und schwarz gemischt. Hintercoxa und -femur schwarz, ventral mit langen blaßgelben Haaren; Tibia ockergelb, beim zweiten Spornpaar mit schwarzem Ring; Sporne ockergelb; Tarsus ockergelb, das letzte Tarsomer schwarz.

Vorderflügel: Ränder schwärzlich; Diskalfleck schwarz, halb so breit wie das Rundfeldchen (ETA); Apikalfeld schwärzlich mit hell ockergelben Strahlen zwischen den Adern; die Glasfelder gut entwickelt, leicht mit ockergelben und weißen Schuppen überstäubt; ETA höher als breit, mäßig konkav gewölbt, schmaler als das Apikalfeld. Ventral: Costal- und Analrand, Cubitalstamm, Adern im Rundfeldchen und Strahlen im Apikalfeld zitronengelb.

Hinterflügel: hyalin mit schwarzbraunem Außenrand, schwarzen Adern und schwarzem keilförmigem Diskalfleck, der den Aderstiel M3—Cu1 erreicht; Fransen grau, lang. Ventral: Vorderrand und Adern zitronengelb; Außenrand und Diskalfleck mit einzelnen zitronengelben Schuppen.

Abdomen: schwarz, die Hinterränder der Tergite 2, 4 und 6 schmal weiß, die Tergite 3—7 noch dicht gelb überstäubt; auf Tergit 2 nur medial spärliche ockergelbe Schuppen; Analbusch schwarz, in der Mitte breit, lateral schmal goldgelb. Lateral über alle Tergite eine durchlaufende goldgelbe Linie. Ventral: schwarz, die Sternite 2 und 3 an den Hinterrändern dünn, 4—7 in fast ganzer Breite dicht goldgelb bestäubt; Analklappen goldgelb.

Differentialdiagnose. *S. hera* ist nahe verwandt und auch ähnlich mit *S. mannii* vom Balkan und aus dem Pontus. Diese Art ist im Durchschnitt kleiner (15—17 mm) und dunkler, die gelben Partien sind bei ihr dunkel statt hell ockergelb, was besonders im Apikalfeld auffällt; das erste Palpusglied ist dorsal schwarz, mit gelber Beimischung (bei *S. hera* gelb mit weißen Schuppen); die Stirn hellgelb bis ockergelb (nicht weiß); die Antenne ventral hellbraun (nicht schwarz); das ETA ist bei *S. mannii* sehr schmal, schmaler als der Diskalfleck, halb so breit wie das Apikalfeld; das Abdomen ist ventral fast ganz schwarz, nur mit einzelnen ockergelben

Schuppen; der Analbusch schwarz, nur bei einigen Exemplaren lateral mit wenigen ockergelben Schuppen, selten auch medial.

Genitalapparat ♂ (Abb. 12). Sehr ähnlich dem von *S. mannii*, die Valve subapikal ein wenig breiter und apikal weniger zugespitzt.

Bionomie und Habitat. Die Bionomie ist unbekannt. Nach dem Charakter der Biotope ist zu vermuten, daß die Raupe ähnlich der verwandten *S. mannii* in einer *Geranium* sp. (Geraniaceae) lebt. Waldsteppen mit sehr reicher Vegetation, Lichtungen in Nadel- und Laubwäldern.

Verbreitung. Bisher nur von den genannten Lokalitäten bekannt.

Derivatio nominis. Die neue Art wird nach der Gattin und Schwester des griechischen Gottes Zeus, der Hüterin der Ehe, benannt.

Dipchasphecia intermedia sp. n. (Abb. 8)

Material. Holotypus ♂, Türkei, Taurus-Gebirge, 10 km N Saimbeyli (Hadjin), 1450 m, 36.07.12° O, 38.03.12° N, 6. 6. 1993 ex larva ex *Acantholimon* sp., K. Špatenka leg., coll. Museum Witt, München; Paratypen: 5 ♂♂, 4 ♀♀ mit gleichen Daten; 30 ♂♂ Türkei, Taurus-Gebirge, Kan-Paß, 1565 m, 38.18° N, 36.21° O, 29.—30. 6. 1991, K. Špatenka leg. et coll.; 2 ♂♂ mit gleichen Daten coll. Z. Laštůvka (Brno, Tschechische Republik); 14 ♂♂, Türkei, Pontus-Gebirge, Gümüş, 1000 m, 40.49° N, 35.10° O, 5. 7. 1991, K. Špatenka leg. et coll.; 2 ♂♂ mit gleichen Daten, coll. Z. Laštůvka; 2 ♂♂, Türkei, Kappadokien, Karain, 1200 m, 30.36° N, 35.04° O, 3. 7. 1991, K. Špatenka leg. et coll.; 1 ♂, gleiche Angaben in coll. A. Kallies; 1 ♂, Kappadokien, Göreme, 1100 m, 20.—28. 6. 1992, H. Riefenstahl und M. Petersen leg., coll. A. Kallies, 1 ♂ mit gleichen Daten in coll. H. Riefenstahl.

Männchen. Spannweite 13,5—21 mm. Labialpalpus weiß, das dritte Glied schwarz durchmischt, lateral mit länglichem schwarzem Strich; Antenne schwarz, Pedicellus und Scapus ventral ockergelb; Stirn weiß, medial mit einzelnen braunen Schuppen; Scheitel schwarz mit einzelnen rostbraunen Schuppen; Halskragen rostbraun.

Thorax: Schwarz; Scapularfleck sehr undeutlich, nur aus einigen weißlichen Schuppen bestehend oder fehlend; Tegula am Innenrand begrenzt ockergelb; Metathorax mit 2 Gruppen von langen weißen Haaren; Thorax lateral mit großem weißlichem oder ockergelbem Axillarfleck. Vordercoxa weiß, -femur, - tibia und -tarsus braun; Tibia am Distalrand ockergelb; Tarsomeren an den Distalrändern weiß; Hinterbein braun, -tibia dorsal, besonders im Medialteil, dicht weiß behaart; Sporne weißlich; Tarsomeren distal weißlich.

Vorderflügel: dunkelbraun mit sehr kleinen Glasfeldern; Costalrand vor dem Apex gelbweiß, das breite braune Apikalfeld mit kurzen weißgelben Strahlen zwischen den Adern; Diskalfleck braunschwarz, breiter oder ebenso breit wie das ETA; alle Glasfelder sehr klein, bei frischen Exemplaren dicht mit weißlichen Schuppen bedeckt; ETA im typischen Fall punktförmig, höher als breit oder rundlich, durch die Adern in 3 Zellen geteilt. Ventral: Ränder und Apikalfeld dicht schmutzigweiß beschuppt.

Hinterflügel: durchsichtig mit schmalem dunkelbraunem Außenrand, braunen Adern, Fransen und bei M2 nach unten gewinkeltem Diskalfleck.

Abdomen: dunkelbraun, die Tergite 2 und 4 breit schmutzigweiß gerandet, Tergit 6 am Distalrand schmal weißlich begrenzt; Analbusch braunschwarz, lateral an der Basis weißlich. Das ganze Abdomen bei frischen Exemplaren leicht mit schmutzigweißen Schuppen bestäubt. Die breiten Hinterränder der Tergite 2, 4, 6 und 7 lateral weißlich. Ventral: braun, Sternit 2 distal breit schmutzigweiß, die Sternite 3—7 mit mehr oder weniger deutlichen, schmalen schmutzigweißen Hinterrändern. Das ganze Abdomen ventral mit vereinzelten weißen Schuppen.

Weibchen. Robuster, mit dickem Abdomen; Stirn schneeweiß; Innenrand der Tegula am Prothorax weißgelb, Meso- und Metathorax breit weiß begrenzt; Prothorax mit deutlicher, ockergelber mediodorsaler Linie. Abdomen dunkelbraun, Tergite 2 und 6 mit schmalem, 4 mit breitem weißlichem Hinterrand; Analbusch mit 2 sublateralen weißlichen Strahlen. Ventral: Sternit 2 braun, dicht weiß überstäubt, Sternite 4—6 mit schmalen weißen Distalrändern, Sternit 3 mit einzelnen weißen Schuppen am Distalrand.

Variabilität. Im Ausmaß der hellen Beschuppung und in der Größe der Glasfelder relativ stark variabel. In Populationen aus dem Taurus-Gebirge kommen selten Exemplare mit größerem ETA und hellerem Apikalfeld vor; bei einem Exemplar aus Kappadokien sind die Labialpalpen fast ganz weiß, die Tegula breit weiß beschuppt, der Costal- und Analrand des Vorderflügels dicht weißlich überstäubt und das Apikalfeld heller, mit längeren weißlichen Strahlen zwischen den Adern. Die drei bekannten Exemplare aus Bulgarien sind dunkler, mit größeren Glasfeldern, die Weibchen mit nur zwei schmalen weißlichen Ringen auf den Tergiten 2 und 4, mit sehr dunklem Apikalfeld und weniger ausgeprägten weißlichen Strahlen im Analbusch, Sternit 2 weißlich, sonst nur 4 distal schmal weißlich begrenzt. Die taxonomische Stellung der Exemplare aus Bulgarien ist bisher nicht ganz klar, weshalb diese nicht in die Typenserie aufgenommen wurden.

Genitalapparat ♂ (Abb. 13). Ähnlich den verwandten Arten. Die ganze Gattung ist genitalmorphologisch sehr einheitlich.

Genitalapparat ♀ (Abb. 14). Wie bei den verwandten Arten.

Differentialdiagnose. Die neue Art ähnelt *Dipchasphecia lanipes* und *D. krocha* und bildet zwischen diesen in vielen Merkmalen einen Übergang. *D. lanipes* aus Südbulgarien ist bisher leider nur in 4 Exemplaren bekannt, die sich aber konstant und deutlich von der neu beschriebenen Art unterscheiden. *D. lanipes* hat ein großes ovales, in 5 Zellen geteiltes Rundfeldchen, ein sehr breites weißgelbes Band auf dem Tergit 4, der Diskalfleck des Vorderflügels ist nur halb so breit oder schmaler als das ETA, der Thorax trägt einen großen weißlichen Scapularfleck, die helle Begrenzung der Tegula fehlt, das Abdomen ist ventral vollständig weißgelb bestäubt, ohne deutliche Ringe. Die Larvalbionomie von *D. lanipes* ist unbekannt, die Raupe lebt aber offensichtlich nicht in *Acantholimon*, sondern eher in einer *Limonium*-Art (Plumbaginaceae). *D. krocha* steht der neuen Art noch wesentlich näher. Sie ist aber deutlich kleiner (Spannweite 10—11,5 mm), hat das Apikalfeld konstant sehr hell, das Abdomen dorsal mit sehr schmalen weißlichen Ringen auf den Tergiten 2, 4 und 6 (oder nur auf 2 und 4), ventral mit schmalen weißen Distalrändern auf den Sterniten 2—7. *D. krocha* lebt ebenfalls in *Acantholimon*, aber in einer anderen, sehr kleinen Art. Die Futterpflanzen von *D. intermedia* sp. n. und *D. krocha* wurden bisher leider nicht genau determiniert, da es sich um eine taxonomisch sehr komplizierte Gattung handelt.

Bionomie. Die Raupe ist einjährig und lebt in den holzigen Wurzeln einer kugelförmigen, dornigen, rotblühenden *Acantholimon* sp., manchmal mehrere Raupen in einer Pflanze. Vor der Verpuppung bauen die Raupen lange, von innen fein ausgesponnene Röhrchen, in denen sie sich auch verpuppen. Die Imagines treten in der Natur im Juni und Anfang Juli auf. Sie fliegen in den späten Nachmittags- und frühen Abendstunden (16—19 Uhr) und sind zu dieser Zeit auch sexuell aktiv.

Habitat. Trockene steinige Plätze mit spärlicher dorniger Steppenvegetation mit im allgemeinen spärlicher Insektenfauna.

Verbreitung. Türkei: Pontus (Gümüš), Taurus (Saimbeyli, Kan-Paß, Malatya, Kayseri), Kappadokien; Süd- und Südost-Bulgarien: Sliven, Schwarzmeerküste südlich von Burgas.

Derivatio nominis. Die Benennung erfolgt in Berücksichtigung der Tatsache, daß die neue Art eine vermittelnde Stellung zwischen den Arten *D. lanipes* und *D. krocha* einnimmt.

Chamaesphecia kautti sp. n. (Abb. 9)

Material. Holotypus ♂, Türkei, Niğde, Ala Dağ, Demirkazik, 25.—26. 7. 1991, 1600 m, P. Kautt leg., coll. Museum Witt, München; Paratypen: 24 ♂♂ 1 ♀ P. Kautt leg., coll. K. Špatenka; 3 ♀ 2 ♂ dtto, 20. 7. 1996, K. Špatenka leg. et coll.

Männchen. Spannweite 22 mm. Kopf: Labialpalpus dunkelbraun, 1. und 2. Glied dorsal und innen elfenbeinfarben durchmischt, 3. elfenbeinfarben mit braunen Schuppen; Stirn hellbraun mit perlmuttartigem Glanz, vor dem Auge mit weißem Saum; Scheitel schwarz; Antenne

braunschwarz, Pedicellus und Scapus ventral elfenbeinfarben; Halskragen dorsal rostbraun, lateral ockergelb.

Thorax: schwarz; Patagia dunkelbraun mit starkem Glanz; Tegula innen schmal ockergelb gerandet; Metathorax am Distalrand mit einzelnen ockergelben Schuppen und weißgelben Haaren und Schuppen; Scapularfleck schmutzigweiß; Axillarfleck ockergelb. Beine: Vordercoxa braunschwarz, caudal am Rand weiß, Femur, Tibia und Tarsus dunkelbraun. Hinterbein dunkelbraun, Tibia beim ersten Spornpaar mit breitem weißem Ring und am Distalrand mit weißen und ockergelben Schuppen.

Vorderflügel: dunkelbraun; Costalkante ockergelb; Cubitalstamm und Analrand mit sehr spärlichen ockergelben Schuppen; im Apikalfeld kurze blaßgelbe Strahlen zwischen den Adern; das Keilfeldchen (ATA) reicht fast bis zur Flügelwurzel; das Längsfeld bis $^2/_3$ der Distanz zum Diskalfleck; das Rundfeldchen (ETA) groß, oval, durch die Adern in 5 Zellen geteilt, die erste Zelle ist vom Costalrand teilweise mit ockergelben Schuppen bestäubt; die Adern im ETA sind ebenfalls teilweise mit ockergelben Schuppen bestäubt; ETA etwa doppelt so breit wie das Apikalfeld und dreimal so breit wie der Diskalfleck. Ventral: Ränder und Adern blaßgelb bestäubt.

Hinterflügel: unbeschuppt, mit braunen Adern, schmalem dunkelbraunem Außenrand und braunen Fransen; Diskalfleck dunkelbraun, rechteckig, dünn auf die Ader M2 auslaufend. Vorderrand und Adern ventral weißgelb durchmischt.

Abdomen: dunkelbraun, mitteldick, mit schmalem Analbusch; Tergite 4 und 6 am Hinterrand schmal weiß gerandet; am Hinterrand des Tergites 7 einzelne schmutziggelbe Schuppen; im dunkelbraunen Analbusch lateral an der Basis und medial einige ockergelbe Schuppen. Ventral schwarzbraun, die Distalränder der Sternite 4—7 mit weißen Schuppen.

Weibchen. Noch dunkler als das Männchen; Vorderflügel: Längsfeld braunschwarz; Rundfeldchen klein, vierzellig, die obere Zelle mit braunschwarzen und blaßgelben Schuppen bestäubt, die untere Zelle nur rudimentär ausgeprägt; Apikalfeld etwa so breit wie ETA, braunschwarz, nur mit vereinzelten ockergelben Schuppen; Hinterbein braunschwarz, nur lateral mit weißlichem Strich am ersten Spornpaar, dorsal beim ersten Spornpaar und am Distalrand mit einigen weißlichen Schuppen; Abdomen schwarzbraun, nur Tergit 4 am Hinterrand weißgelb umrandet. Sternit 4 am Hinterrand mit einer Reihe weißer Schuppen, 6 mit vereinzelten weißen Schuppen.

Variabilität. Nur bei den Männchen beurteilt, da nur wenige Weibchen bekannt sind. Bei manchen Männchen ist die ockergelbe Mediallinie auf dem Abdomen gut sichtbar, die von den Fleckchen auf den Tergiten 3—6 gebildet wird. Bei solchen Exemplaren können auch ganz vereinzelte weiße Schuppen am Hinterrand des Tergites 2 und eine ganz kurze ockergelbe Mediallinie auf dem Thorax vorhanden sein. Einige Männchen haben fast schwarze Labialpalpen, manche wieder einen nicht rechteckigen, sondern leicht keilförmigen Diskalfleck des Hinterflügels.

Genitalapparat ♂ (Abb. 15). Ähnelt dem von *Ch. bibioniformis* (Esper, 1800); Valve langgezogen, kahle Fläche groß, Crista sacculi breit, einfach, Scopula fehlend, Crista gnathi sehr niedrig und kurz.

Genitalapparat ♀ (Abb. 16). Ähnlich wie bei den verwandten Arten.

Differentialdiagnose. *Ch. kautti* sp. n. ist nahe verwandt mit den Arten der *Ch. bibioniformis*-Gruppe und ähnelt aus dieser besonders *Ch. taurica* sp. n. Ferner ähnelt sie habituell auch *Ch. guriensis* (Emich von Emöke, 1872) und *Ch. kistenjovi* Gorbunov, 1991, aus Transkaukasien. *Ch. taurica* unterscheidet sich schon auf den ersten Blick durch die Gestalt: sie ist kleiner, schlanker und hat größere Glasfelder des Vorderflügels. Sie unterscheidet sich unter anderem auch durch weitere Details, so z. B. den schneeweißen Labialpalpus (bei *Ch. kautti* sp. n. braun), die außen ockergelbe Antenne (bei *Ch. kautti* sp. n. schwarzbraun), den schneeweißen Scapularfleck (bei *Ch. kautti* sp. n. ockergelb), die schneeweiße Vordercoxa (bei *Ch. kautti* sp. n. braunschwarz, nur weiß umrandet), das sehr schwach entwickelte braunschwarze Apikalfeld (bei *Ch. kautti* sp. n. breit, mit kurzen ockergelben Strahlen), den strichförmigen Diskalfleck im Hinterflügel (bei *Ch. kautti* sp. n. breit), die weißen Ringe auf den Tergiten 2, 4 und 6 (bei *Ch. kautti* sp. n. nur auf 4 und 6), das weiße Abdominalsternit 4 (bei *Ch. kautti* sp. n. braun-

schwarz). Die beiden obengenannten transkaukasischen Arten gehören in die *Ch. empiformis*-Gruppe, haben also keinen hellen Scapularfleck, den Thorax lateral dunkel und einige Abdominaltergite auf der ganzen Oberfläche diffus weißlich oder weißgelb bestäubt.

Bionomie und Habitat. Die Raupe ist wahrscheinlich nur einjährig und lebt in dicken Wurzeln von *Euphorbia kotschgiana* (Euphorbiaceae). Diese mächtige Pflanze ist in den schotterigen Anschwemmungen im Bachtal und an den kahlen Kalkfelsen oberhalb von Demirkazik am Ala-Dag sehr dominant. Die Falter sind sehr scheu und setzen sich bei Sonnenschein auf die dürren Stengel der Futterpflanze.

Derivatio nominis. Die Benennung erfolgt zu Ehren des Entdeckers dieser neuen Art.

Chamaesphecia taurica sp. n. (Abb. 10)

Material. Holotypus ♂, Türkei, Südanatolien, Taurus-Gebirge, Çamlıyayla (Namrun), 1200 m, 37.11° N, 34.39° O, 26.—27. 7. 1991, K. Špatenka leg., coll. Museum Witt, München; Paratypen: 7 ♂♂ mit gleichen Daten, coll. K. Špatenka; 1 ♂ mit gleichen Daten in coll. I. Toševski (Beograd, Jugoslawien).

Männchen. Spannweite 19 mm. Labialpalpus schneeweiß, das dritte Glied blaßgelb, apikal braunschwarz durchmischt; Stirn dunkelbraun mit perlmuttartigem Glanz, Auge ventral weiß gerandet; Scheitel glänzend schwarz; Antenne dunkelbraun, außen ockergelb, Pedicellus und Scapus ventral ockergelb; Halskragen rostbraun, lateral weiß.

Thorax: braunschwarz; Tegula innen schmal ockergelb gerandet; Metathorax mit vereinzelten dünnen ockergelben Haaren und mit zwei Gruppen gelbweißer Schuppen am Hinterrand; Patagia lateral ockergelb, unter den Flügeln ein großer schneeweißer Fleck; Scapularfleck schneeweiß. Vordercoxa schneeweiß, Femur, Tibia und Tarsus braun mit weißer Beimischung; Hintercoxa und Femur schwarz, ventral mit schneeweißen Schuppen und Haaren, Tibia dorsal braunschwarz, am Distalrand weiß, lateral beiderseits weiß, distal mit breitem dunkelbraunem Saum, am Distalrand schneeweiß, ventral von der Basis zum ersten Spornpaar schwarz, dann bis zur Mitte zwischen beiden Spornpaaren weiß und das distale Drittel wieder braunschwarz, beide Spornpaare schneeweiß, Tarsus braun, das erste Tarsomer dorsal mit ockergelben Schuppen bestäubt, an den Distalenden der übrigen Tarsomere immer einzelne ockergelbe Schuppen; ventral braun, an den Distalenden der Tarsomere leicht ockergelb bestäubt.

Vorderflügel: mit abgerundetem Apex und sehr gut entwickelten Glasfeldern; Ränder, Adern, Diskalfleck und Fransen braunschwarz, Apikalfeld stark reduziert, braunschwarz; Costalkante bis zum Diskalfleck ockergelb, dann bis zum Vorderapex braunschwarz, subapikal aber mit weißem Fleck; ATA bis zur Flügelwurzel reichend; PTA fast zum Diskalfleck; ETA sehr groß, länger als hoch, durch die Ader in 5 Zellen geteilt; Adern im ETA mit einzelnen ockergelben Schuppen; Apikalfeld sehr schmal, in der Mittelpartie nur ein Viertel so breit wie das ETA, einfarbig braunschwarz. Ventral: Costal-, Analrand und Cubitalstamm dicht ockergelb beschuppt.

Hinterflügel: unbeschuppt mit braunschwarzen Adern und Fransen, der sehr schmale Außenrand und Diskalfleck ebenfalls braunschwarz; Fransen am Analrand und Adern an der Flügelwurzel weiß; Diskalfleck sehr schmal, strichförmig, den Aderstiel M3—Cu1 erreichend.

Abdomen: dorsal braunschwarz, die Tergite 2, 4 und 6 mit schmalen weißen Hinterrändern, alle Tergite mediodorsal schwach ockergelb bestäubt, diese Bestäubung von Tergit 1 bis 7 abnehmend und eine undeutliche schmale Mediallinie bildend; Analbusch dreieckig, in drei Büschel geteilt, craniolateral und medial mit einzelnen ockergelben Schuppen, sonst braunschwarz. Ventral dunkelbraun, Sternit 2 schneeweiß, 4 in der hinteren Hälfte schneeweiß, 5—7 medial mit einzelnen schmutzigweißen Schuppen, weiße Fleckchen auch an den seitlichen Hinterrändern der Tergite 3, 5 und 6; Analklappen dunkelbraun, caudal ockergelb.

Weibchen. Unbekannt.

Variabilität. Größe 16,5—21 mm; Scheitel bei ganz frischen Exemplaren mit einzelnen rostbraunen Schuppen, auf dem Prothorax ist eine mediale ockergelbe Linie angedeutet, und die weiße Umrandung der Abdominaltergite 2, 4 und 6 ist leicht ockergelb überstäubt.

Genitalapparat ♂ (Abb. 17). Ähnlich *Ch. bibioniformis.*

Differentialdiagnose. Ähnlich und verwandt mit *Ch. bibioniformis*, von dieser aber in mehreren Merkmalen veschieden. Die polymorphe *Ch. bibioniformis* bildet in ihrem umfangreichen Verbreitungsgebiet mehrere Ökoformen von unsicherer taxonomischer Stellung. Stücke aus Spanien und Südfrankreich (Futterpflanzen: *Euphorbia nicaensis*, *E. serrata*; Euphorbiaceae) sind auffallend groß und robust, von gelbbrauner Grundfarbe und mit sehr großem ETA; in Mitteleuropa, auf dem Balkan, in der Türkei, in Südrußland und in Transkaukasien finden wir Populationen mit breiterem Apikalfeld und grünlicher Grundfarbe vor (Futterpflanze: *E. segueriana*); in Mazedonien lebt die Art auch in *E. myrsinites* und *E. niciciana*, und die Imagines sind auffallend stark gelb bestäubt. In Kappadokien (Türkei) zeichnet sich die Art durch eine sehr reiche weiße Bestäubung aus (Futterpflanze: *Euphorbia* sp.). Alle diese Formen haben freilich ein breites Apikalfeld mit hellen Strahlen zwischen den Adern und weißer Umrandung des 7. Abdominaltergites. Bei *Ch. taurica* sp. n. ist das Apikalfeld hingegen extrem schmal und einfarbig braunschwarz, und Tergit 7 ist einfarbig braunschwarz.

Bionomie. Die Larvalbionomie ist bisher unbekannt, auf der Typenlokalität hat der Autor aber nur *Euphorbia kotschyana* (Euphorbiaceae) gefunden, die damit die potentielle Futterpflanze darstellt.

Habitat. Die Typenlokalität ist eine sehr pflanzenreiche Waldsteppe in Çamlıyayla. Das Gebiet um Çamlıyayla stellt eine feuchte Enklave im sonst sehr trockenen südöstlichen Taurus dar. Gemeinsam mit *Ch. taurica* sp. n. wurden an der Typenlokalität folgende Glasflügler gesammelt: *Tintia myrmosaeformis* (Herrich-Schäffer, 1846), *Paranthrene insolita insolita* Le Cerf, 1914, *Synanthedon myopaeformis* (Borkhausen, 1789), *Bembecia illustris* (Rebel, 1901), *Pyropteron minianiforme* (Freyer, 1843), *Chamaesphecia haberhaueri* (Staudinger, 1879), *Ch. proximata* (Staudinger, 1891), *Ch. alysoniformis* (Herrich-Schäffer, 1846) und von anderen Autoren auch *Osminia fenusaeformis* (Herrich-Schäffer, 1852) und *Euhagena palariformis* (Lederer, 1858).

Derivatio nominis. Die Art wird nach ihrem Fundgebiet, dem Taurus-Gebirge, benannt.

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Zusammenfassung

Der Autor legt Beschreibungen von neun neuen Glasflüglerarten und -unterarten vor. *Bembecia peterseni* sp. n. wurde in größerer Anzahl an mehreren Lokalitäten in Anatolien (Türkei) gefangen; sie ähnelt mehreren Arten der Gattung *Bembecia* und ist nahe mit *B. iberica* aus Frankreich, Spanien und Marokko verwandt. *Synansphecia hera* sp. n. wird in mehreren Exemplaren aus dem Taurus (Türkei) beschrieben und ist mit *S. mannii* verwandt. *Dipchasphecia intermedia* sp. n. wurde im Pontus und im Taurus (Türkei) gefangen und gezüchtet; sie ähnelt *D. lanipes* und *D. krocha*; die Raupe lebt in *Acantholimon* sp. *Chamaesphecia kautti* sp. n. aus Niğde (Türkei) ist nahe mit *Ch. bibioniformis* verwandt. In die gleiche Gruppe gehört auch *Chamaesphecia taurica* sp. n. *Synanthodon stomoxiformis riefenstahli* ssp. n. aus Südspanien, *Synanthedon andrenaeformis tenuicingulata* ssp. n. aus der Nordost-Türkei und aus Armenien, *Bembecia pavicevici dobrovskyi* ssp. n. vom Taygetos (Griechenland) und *Bembecia syzcjovi kappadocica* ssp. n. aus Kappadokien (Türkei) stellen neue geographische Unterarten bereits bekannter Arten dar.

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Review of the genus *Paradoxecia* Hampson, 1919 (Lepidoptera, Sesiidae, Tinthiinae)

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Abstract. The clearwing moths of the genus *Paradoxecia* Hampson, 1919 are reviewed. Two new species, *P. vietnamica* sp. n., and *P. fukiensis* sp. n. are described from Vietnam and southeastern China, respectively. Redescriptions of *P. gravis* (Walker, [1865]) and *P. pieli* Lieu, 1935 are also provided. A key to all taxa currently known for the genus is compiled.

Key words. Sesiidae, Tinthiinae, *Paradoxecia*, new species, taxonomy, Vietnam, China.

The genus *Paradoxecia*, erected by Hampson (1919) for *Aegeria gravis* Walker, [1865], originated from "North China" [=eastern China, Shanghai ?]. In 1935, K.O. Victoria Lieu described *P. pieli* after a series of specimens reared from larvae, boring in mulberry-tree twigs in eastern China. Until now, *Paradoxecia* contained only these two species. In 1933, Gaede placed *Paranthrene croconeura* Meyrick, 1926, a species from Sikkim, India, in *Paradoxecia*, as did Heppner & Duckworth (1981). However, we believe *croconeura* neither belongs to the genus *Paradoxecia*, nor even to the subfamily Tinthiinae. This species seems to belong to the genus *Adixoa* Hampson, [1893] or a closely related genus of the Paranthreninae. So, we remove *croconeura* from the genus *Paradoxecia*.

While investigating the Oriental Sesiidae from the collections of Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany and Muséum d'Histoire Naturelle, Genève, Switzerland, we came across a few highly interesting specimens from Vietnam and southeastern China belonging to the genus *Paradoxecia* and distinct from the two known species of this genus. We describe the two unique species below. So, at present, the genus *Paradoxecia* includes four species, viz. *P. gravis* (Walker, [1865]), *P. pieli* Lieu, 1935, *P. vietnamica* sp. n., and *P. fukiensis* sp. n. In addition, we redescribe *P. gravis* and *P. pieli* and present a key to all known species of *Paradoxecia*.

Material examined or cited herein has been deposited in the following collections abbreviated in the text as follows: BMNH The Natural History Museum, London, Great Britain; ZFMK Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany; MHNG Muséum d'Histoire Naturelle, Genève, Switzerland; MUT Zoological Laboratory, Faculty of Agriculture, Meijo University, Nagoya, Japan; CG collection of O. Gorbunov, Moscow, Russia.

Subfamily Tinthiinae, Tribe Tinthiini Le Cerf

Tinthiinae Le Cerf, 1917: 148. Type genus Tinthia Walker, [1865].

Genus *Paradoxecia* Hampson

Paradoxecia Hampson, 1919: 51 (key), 114 (description). Type-species: *Aegeria gravis* Walker, [1865], by original designation. Dalla Torre & Strand 1925: 180; Gaede 1933: 797 (part.); Naumann 1971: 22, 55; Heppner & Duckworth 1981: 21 (part.); Fletcher & Nye 1982: 118.

Medium or large-sized clearwing moths with alar expanse 19—40 mm. Head with antenna filiform, shortly bipectinate and ciliate in male, without hair tuft apically; proboscis well-developed, long, functional; frons and vertex smooth, covered with elongate scales; labial palpus smooth-scaled. Legs with tibia and first tarsomere with short tufts of elongate, apically pointed and rusty coloured setae. Forewing entirely opaque, sometimes with a short and narrow semihyaline stripe in place of posterior transparent area; veins R4 and R5 separate, Cu2 short, stalked with Cu1 (Fig. 7). Hindwing transparent or densely covered with semihyaline with brownish or yellowish tinged scales; veins M1 and M2 nearly reduced basally; vein M2 arising slightly before cross-vein, M3 and Cu1 arising long before cross-vein; A1 well-developed (Fig. 7). Male genitalia (Fig. 10) with uncus well-developed, finger-shaped, covered with simple short setae, well separated from tegumen; tegumen triangular, broad, without gnathos; valva broad, rounded distally, covered with simple hairs and setae; saccus short and broad; aedeagus narrow, long, about twice as long as valva, with long coecum penis and with a strong thorn distally where penis broadens dorsally; vesica with numerous minute spinules. Female genitalia (Figs 8—9) with 8th tergite well-sclerotized, with numerous long setae at distal margin; papillae anales strongly sclerotized with outside curved ventral margin, or nearly membranous, with short setae; apophysis posterior somewhat shorter, equal or longer than apophysis anterior; latter sometimes with distinct ventral appendix; lamella postvaginalis sometimes sclerotized; ostium bursae membranous, on intersegmental membrane; antrum short, broad, slightly or well-sclerotized; ductus bursae short and broad, membranous; corpus bursae ovoid, membranous, without or with one or two signa.

Diagnosis. *Paradoxecia* seems to be closely related with *Tinthia, Microsphecia* Bartel, 1912 (distinct, not congeneric with *Tinthia*), *Paranthrenopsis* Le Cerf, 1911, and *Zenodoxus* Grote & Robinson, 1868. From all of these genera, *Paradoxecia* differs by the relatively larger size and by the short bipectinate antenna in the male (ciliate in these compared genera). In addition, *Paradoxecia* can be distinguished from *Tinthia* and *Microsphecia* by the shape of the aedeagus in the male genitalia (relatively short and broad with short cecum penis in these compared genera) and by the shape of the female genitalia (8th tergite and both pairs of apophyses relatively longer, antrum long in *Tinthia* and *Microsphecia*). *Paradoxecia* is distinguishable from *Zenodoxus* by the well-developed uncus and form of the distal part of the aedeagus (uncus small, aedeagus without thorn distally in *Zenodoxus*). This genus can be separated from *Paranthrenopsis* by the entirely opaque forewing (with small transparent areas in *Paranthrenopsis*) and by the shape of tegumen in the male genitalia (small, poorly developed in *Paranthrenopsis*). Additionally, *Paradoxecia* can easily be distinguished from the genus *Trichocerota* Hampson, [1893] by the larger size, entirely opaque forewing and differences in both male and female genitalia.

Structure. The genus *Paradoxecia* currently consists of four species, viz. *P. gravis* (Walker, [1865]), *P. pieli* Lieu, 1935, *P. vietnamica* sp. n., and *P. fukiensis* sp. n.

Distribution. Known from the northeastern continental part of the Oriental Region: Vietnam, eastern and southeastern China. Including *P. gravis* in the Palaearctic sesiid fauna (Naumann 1971; Spatenka et al. 1993) is probably incorrect, because *P. gravis* is known only from "North China", which, in our opinion, is most likely Shanghai, a location somewhat south of the Palaearctic Region (Heppner 1991).

Key to species of *Paradoxecia* based on external characters

1. Abdomen dorsally only with yellow coloured stripes 2
— Abdomen dorsally without yellow coloured stripes or with yellow and dirty orange stripes 3
2. Alar expanse more than 35.0 mm; labial palpus white ventrally and light brown dorsally; abdomen ventrally entirely dark brown .... *gravis*
— Alar expanse less than 35.0 mm; labial palpus pale ochreous with a few brown scales both basally and apically; abdomen ventrally with narrow yellow stripes distally .... *pieli*
3. Abdominal tergite 4 with a narrow yellow stripe proximally; tergites 5 and 6 each with a narrow dirty orange stripe distally; ventrally sternite 4 with a broad yellow stripe proximally .... *fukiensis* sp. n.
— Abdominal tergite 4 with two small orange spots lateroanteriorly; ventrally abdomen entirely dark brown with violet sheen .... *vietnamica* sp. n.

Paradoxecia gravis (Walker) (Figs 1—2)

Aegeria gravis Walker, [1865]: 31. Type locality: "North China" [= eastern China, Shanghai ?]. Holotype female (BMNH).

Hampson 1919: 114 (*Paradoxecia*); dalla Torre & Strand 1925: 180 (*Paradoxecia*); Gaede 1933: 797 (*Paradoxecia*); Heppner & Duckworth 1981: 22 (*Paradoxecia*); Spatenka et al. 1993: 85 (*Paradoxecia*).

Redescription. Female (holotype) (Fig. 1). Alar expanse 39.5 mm; body length 17.3 mm; forewing 17.7 mm; antennae broken off.

Head: antennae broken off; frons rubbed out; labial palpus white ventrally and light brown dorsally; vertex dark brown; pericephalic hairs white.

Thorax: patagia dark brown; tegula dark brown to black with a narrow yellow inner margin; meso- and metathorax nearly without scales, dark brown; thorax laterally grey-brown.

Legs: fore coxa entirely dark brown; hind tibia dark brown with two tufts of rusty, longitudinal and apically pointed scales; inserting both medio-dorsally and apically; spurs dark brown.

Abdomen: dark brown; tergite 1 laterally yellow; tergites 2—5 each with a yellow, narrow, distal margin; ventrally entirely dark brown.

Forewing: entirely opaque, dark brown with violet sheen; cilia denuded.

Hindwing: transparent with brownish tingle; veins and outer margin dark brown; discal spot undeveloped; outer margin narrow, ca. twice as narrow as cilia; cilia dark brown.

Female genitalia. Not studied.

Male. Unknown.

Variability. Unknown.

Diagnosis. This species is closest to *P. pieli* Lieu and differs from it by the larger size (alar expanse up to 30.0 mm in *pieli*) and ventral coloration of the abdomen (sternites 1+2, 3, 4 and 5 each with a very narrow, yellow to pale yellow, distal margin in *pieli*). It can easily be distinguished from *P. vietnamica* sp. n. and *P. fukiensis* sp. n. by the coloration of the abdomen (tergite 4 with two small orange spots latero-anteriorly in *vietnamica* sp. n. and tergite 4 with a narrow yellow stripe proximally, tergites 5 and 6 each with a narrow dirty orange stripe distally in *fukiensis* sp. n.). These three species are also distinguishable from each other by the numerous details of the coloration of the body (see descriptions for *P. vietnamica* sp. n. and *P. fukiensis* sp. n.).

Bionomics and habitat. Unknown.

Distribution. Known only from the type locality: "North China" [eastern China, Shanghai ?].

Material examined. 1 female (holotype), with labels as in Fig. 2 (BMNH).

Paradoxecia pieli Lieu (Fig. 3)

Paradoxecia pieli Lieu, 1935: 193, figs 1—39. Type locality: China, Hangchow [= eastern China, Zhejiang, Hangzhou]. Holotype male (probably lost, was kept in the author's collection, Musée Heude, Shanghai). Naumann 1971: 55, figs 18, 57, 172 (as *P. gravis*, misidentification); Heppner & Duckworth 1981: 22.

Description. Female (Fig. 3). Alar expanse 30.0 mm; body length 15.0 mm; forewing 13.5 mm; antenna 5.2 mm.

Head: antenna dark brown with purplish violet sheen; frons brown; labial palpus pale ochreous with a few brown scales both basally and apically; vertex brown; pericephalic hairs dark yellow dorsally and white laterally.

Thorax: patagia brown with a large dark yellow spot lateroposteriorly; tegula brown with a few yellow scales apically; meso- and metathorax brown; thorax laterally brown with a small dark yellow spot at base of forewing.

Legs: fore coxa entirely brown to dark brown with violet sheen; hind tibia greyish-brown with violet sheen, internally slightly paler, with two tufts of rusty, longitudinal and apically pointed scales, inserting both medio-dorsally and apically; spurs greyish-brown.

Abdomen: brown with violet sheen; tergite 1 yellow laterally; tergites 2, 4 and 5 each with a narrow yellow margin distally; sternites 1+2, 3, 4 and 5 each with a very narrow, yellow to pale yellow, distal margin; anal tuft small, brown.

Forewing: entirely opaque, brown with violet sheen, basally somewhat darker; cilia brown with violet sheen.

Hindwing: densely covered with semitransparent scales with brownish hue, except on distal half where sparsely covered with brown scales; veins and outer margin brown; discal spot undeveloped; outer margin narrow, ca. twice as narrow as cilia; cilia brown with violet sheen.

Female genitalia (Naumann 1971: fig. 172). 8th tergite relatively short but broad, well-sclerotized, with numerous long setae at distal margin; papilla anales relatively small, slightly sclerotized, with numerous short setae; apophysis posterior somewhat longer than apophysis anterior; latter with distinct, long, ventral appendix; ostium bursae membranous; antrum short, broad, well-sclerotized; ductus bursae short and broad, membranous; corpus bursae ovoid, membranous, with an elongate signum.

Male. Somewhat smaller: alar expanse 19.6—22.5 mm; body length 10.6—13.0 mm (Lieu 1935).

Variability. Varies in individual size: alar expanse 19.6—30.0 mm; body length 10.6—15.0 mm. Sometimes abdominal tergite 3 with a narrow yellow margin distally.

Diagnosis. This species seems closest to *P. gravis* (Walker, [1865]) and differs from it by the individual size (alar expanse 39.5 mm in *gravis*) and coloration of the abdomen ventrally (entirely dark brown in *P. gravis*). It is possible that *P. pieli* is only a form of *gravis*. Unfortunately, only a single female (holotype) of *gravis* is known and its genitalia were not studied. From *P. vietnamica* sp. n. and *P. fukiensis* sp. n., *P. pieli* can easily be distinguished by the key given above. See also "Diagnosis" for comparisons of these species.

Bionomics (after Lieu 1935). The host plant is *Morus* sp. (mulberry) (Moraceae). The larva lives inside the thin twig, occasionally in a thick branch. Its development requires one year; the imago appears in July.

Habitat. Mulberry orchards.

Distribution. Known only from eastern China, prov. Zhejiang.

Material examined. 1 female, China, Hangchow [Hangzhou], 1. VII. 1934 (MUT).

Paradoxecia vietnamica sp. n. (Figs 4, 8)

Description. Female (holotype) (Fig. 4). Alar expanse 31.6 mm; body length 12.3 mm; forewing 15.5 mm; antenna 5.3 mm.

Figs 1—6: *Paradoxecia* spp. 1. *P. gravis* Walker, [1865], holotype, female (BMNH). Alar expanse 39.5 mm. 2. Ditto, labels. 3. *P. pieli* Lieu, 1935, female, China, Hangchow [Hangzhou], 1. VII. 1934 (MUT). Alar expanse 30.0 mm. 4. *P. vietnamica* sp. n., holotype, female (MHNG). Alar expanse 31.6 mm. 5. *P. fukiensis* sp. n., holotype, female (ZFMK). Alar expanse 28.0 mm. 6. Ditto, paratype, male (ZFMK). Alar expanse 24.2 mm.

Head: antenna dark brown to black with violet sheen; frons dark brown; labial palpus orange with a few pale yellow scales apically; vertex dark brown; pericephalic hairs yellow-orange dorsally and white laterally.

Thorax: patagia dark brown to black with bronze-violet sheen, with a small orange spot lateroanteriorly; tegula, meso- and metathorax dark brown with violet sheen; thorax laterally dark grey with violet sheen.

Legs: fore coxa dark brown with bronze-violet sheen, with a few orange scales basally; hind tibia dark brown with bronze-violet sheen, with two tufts of rusty, longitudinal and apically pointed scales; both inserting medio-dorsally and apically; spurs dark brown externally and white internally.

Abdomen: dorsally dark brown to black with violet sheen; tergite 4 with two small orange spots lateroanteriorly; ventrally entirely dark brown with violet sheen; anal tuft small, dark brown to black with violet sheen.

Forewing: black basally; costal margin dark brown with a narrow, longitudinal, light brown line; rest of surface covered with dark brown with violet sheen, with a few light brownish scales; transparent areas undeveloped, but covered with slightly lighter scales; cilia dark brown with bronzed sheen.

Hindwing: transparent with yellowish hue; veins and outer margin dark brown; discal spot undeveloped; outer margin about twice as narrow as cilia; cilia dark brown with bronzed sheen.

Female genitalia. (holotype, genital preparation No. GA—045) (Fig. 8). 8th tergite narrow, well-sclerotized, with numerous long setae at distal margin; papilla anales strongly sclerotized with curved outside ventral margin, with a few short setae; apophysis posterior somewhat shorter than apophysis anterior; latter without ventral appendix; ostium bursae membranous; antrum short, broad, slightly sclerotized; ductus bursae short and broad, membranous; corpus bursae ovoid, membranous, without signum.

Male. Unknown.

Variability. Unknown.

Diagnosis. This new species can be distinguished from *P. pieli* by the orange labial palpus (pale ochreous with a few brown scales in the species compared), coloration of the patagia (with a large dark yellow spot lateroposteriorly in *pieli*) and abdomen (tergites 2, 4 and 5, sometimes 3, each, with a narrow yellow strip distally in the species compared) and by the transparent hindwing (semitransparent with brownish hue, with distal half sparsely covered with brown scales in *pieli*). From *P. gravis, vietnamica* sp. n. differs by the smaller size (alar expanse 39.5 mm in *gravis*) and by the coloration of the abdomen and hindwing. The new species is easily distinguishable from *P. fukiensis* sp. n. by the coloration of the abdomen (tergite 4 with a narrow yellow strip proximally; tergites 5 and 6 each with a narrow dirty orange strip distally; laterally segment 1 yellow; ventrally sternite 4 with a broad yellow strip proximally in the species compared). Also, *P. vietnamica* sp. n. is clearly separated from *P. pieli* and *P. fukiensis* sp. n. by the female genitalia (compare fig. 9, and Naumann 1971: fig. 172).

Bionomics. The host plant is unknown. The moth has been netted near the end of May.

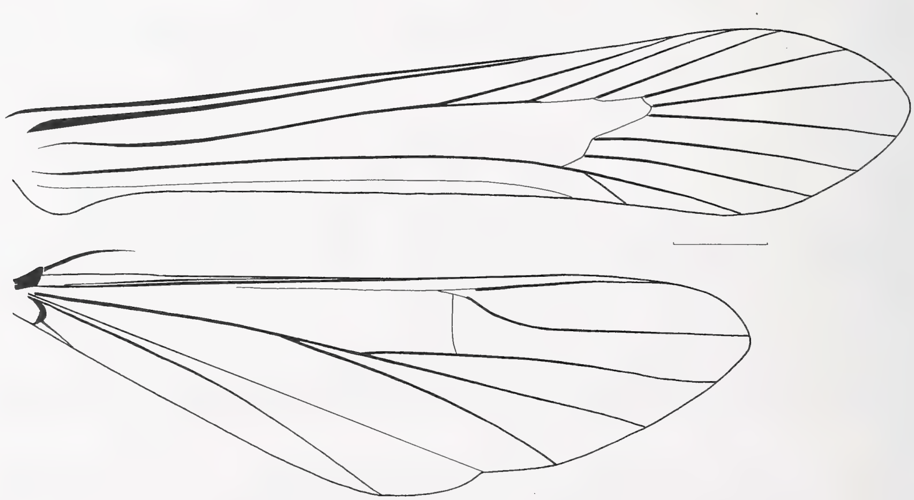
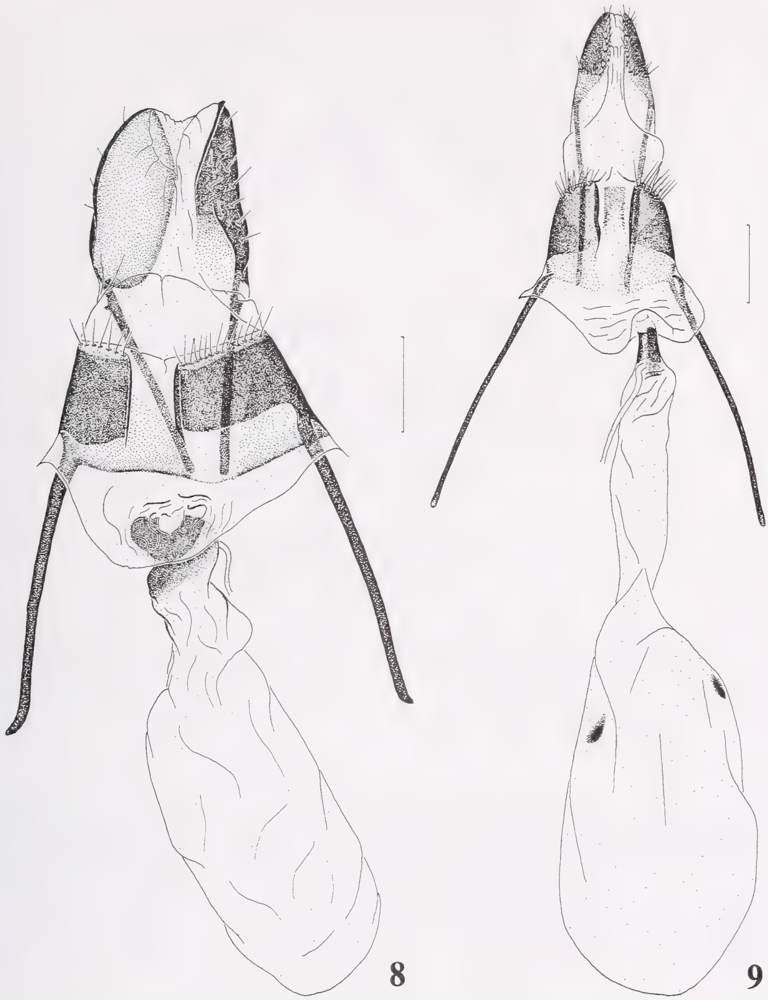


Fig. 7: Wing venation of *P. fukiensis* sp. n. Scale bar: 1.0 mm.



Figs 8—9: Female genitalia of *Paradoxecia* spp. 8. *P. vietnamica* sp. n., holotype (genital preparation No. GA—045). Scale bar: 0.5 mm. 9. *P. fukiensis* sp. n., paratype (genital preparation No. GA—075). Scale bar: 0.5 mm.

Habitat. Unknown.

Distribution. Known only from Vietnam.

Material examined. 1 female (holotype), Vietnam, Pahia, 24. V. 1950, J. Romieux leg. (MHNG).

Paradoxecia fukiensis sp. n. (Figs 5—6, 9—10)

Description. Female (holotype) (Fig. 9). Alar expanse 28.0 mm; body length 14.0 mm; forewing 13.0 mm; left antenna broken off, right one with broken tip.

Head: antenna dark brown to black with greenish sheen; frons dark brown with gold-green sheen, with a few dirty orange-yellow scales laterally; vertex dark brown with golden-green sheen; labial palpus pale yellow basally and dirty yellow distally; pericephalic hairs dirty yellow dorsally and pale yellow laterally.

Thorax: patagia dark brown with purple-green sheen, with a few dirty yellow scales latero-posteriorly; tegula dark brown with green-violet sheen, with a narrow dirty orange inner margin; meso-, metathorax and thorax laterally dark brown with green-violet sheen.

Legs: fore coxa dark brown with golden sheen, mixed with individual dirty orange scales; hind tibia dark brown with purple-violet sheen, with a few yellow-orange scales ventrally, with two tufts of rusty, longitudinal and apically pointed scales; both inserting medio-dorsally and apically; spurs dark brown.

Abdomen: segments 1-3 black with purple sheen, all other segments dark brown; dorsally tergite 4 with a narrow yellow stripe proximally; tergites 5 and 6 each with a narrow dirty orange stripe distally; laterally segment 1 yellow; ventrally sternite 4 with a broad yellow stripe proximally; anal tuft small, dark brown tipped with light brown.

Forewing: dark brown with bronzed sheen, mixed with individual light brown scales; costal margin narrowly dirty orange; anterior transparent area undeveloped; posterior transparent area very narrow and short, covered with semihyaline brownish scales with blue hue; external transparent area undeveloped, but scales between veins M3 and Cu1 somewhat lighter and with bluish hue; cilia dark brown.

Hindwing: transparent but densely covered with translucent scales with slightly brownish hue; veins dark brown mixed with a few dirty orange scales; outer margin dark brown, narrow, about twice as narrow as cilia; discal spot undeveloped; cilia dark brown.

Female genitalia. (paratype, genital preparation No. GA—075) (Fig. 9). 8th tergite relatively short and narrow, well-sclerotized, with numerous long setae at distal margin; papillae anales relatively small, slightly sclerotized, with numerous short setae; apophysis posterior somewhat shorter than apophysis anterior; latter with a short ventral appendix; ostium bursae membranous; antrum short, narrow, well-sclerotized; ductus bursae relatively long and broad, membranous; corpus bursae ovoid, membranous, with two oval signa.

Male. Generally less robust than female. Colour pattern as in female (Fig. 6).

Male genitalia. (paratype, genital preparation Nos GA—102 and 1570 YA) (Fig. 10). Uncus well-developed, finger-shaped, covered with simple short setae, well separated from tegumen; tegumen triangular, broad, without gnathos (Fig. 10a); valva broad, rounded distally, covered with simple short hairs and long setae (Fig. 10b); saccus short and broad, rounded basally (Fig. 10c); aedeagus narrow, long, about twice longer than valva, with long coecum penis and with a strong thorn distally where penis broadens dorsally; vesica with numerous minute spinules (Fig. 10d).

Variability. Vary only in individual size, not in coloration. Size varies as follows. Males: alar expanse 23.0—25.0 mm; body length 11.0—12.0 mm; forewing 10.5—11.5 mm; antenna 4.5—5.0 mm; females: alar expanse 22.5—32.0 mm; body length 10.5—15.0 mm; forewing 9.5—14.5; mm antenna 4.0—5.2 mm.

Diagnosis. By the coloration of the abdomen (bicoloured background coloration and bicoloured stripes) this species can not be confused with any other congeners. Additionally, by the shape of papilla anales and signum of the corpus bursae of the female genitalia, *fukiensis* sp. n. is clearly distinguishable from *pieli* and *vietnamica* sp. n.

Bionomics. The host plant is unknown. Imagines were collected during June at an altitude of about 2300 m.

Habitat. Unknown.

Distribution. Southeastern China, prov. Fujian. Known only from the type locality.

Material examined. Holotype female, China, Fukien, Kuatun, 2300 m, 27—40 N, 117—40 E, 13. VI. 1938, J. Klapperich leg. (ZFMK). Paratypes: 1 male, same locality as holotype, 8. VI. 1938, J. Klapperich leg. (ZFMK); 2 males, same locality as holotype, 26. VI. 1936,

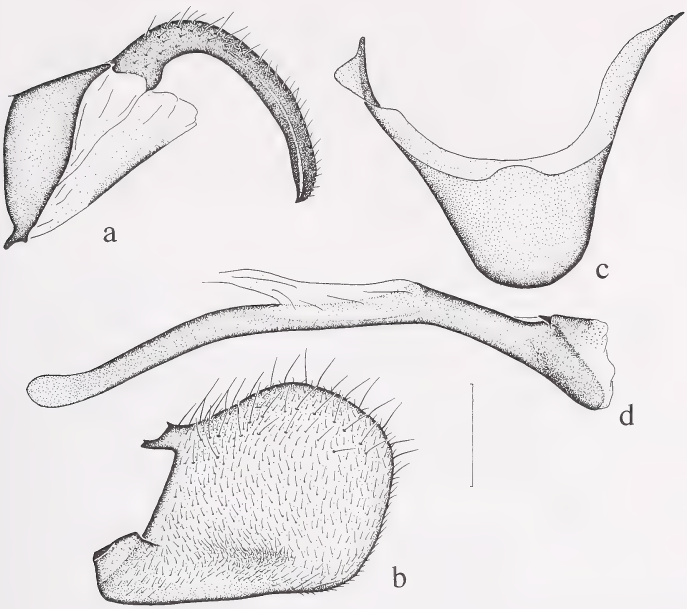


Fig. 10: Male genitalia of *P. fukiensis* sp. n., paratype (genital preparation Nos GA—102 and 1570 YA). a. Tegumen-uncus complex. b. Valva. c. Saccus. d. Aedeagus. Scale bar: 0.5 mm.

H. Höne leg. (ZFMK); 1 female, same locality as holotype, 8. VI. 1938, J. Klapperich leg. (CG); 1 female, same locality as holotype, 15. VI. 1938, J. Klapperich leg. (ZFMK); 1 male, 3 females, same locality as holotype, 16. VI. 1938, J. Klapperich leg. (male with genital preparation No. 1570 YA, GA—102) (MUT, ZFMK); 1 female, same locality as holotype, 25. VI. 1936, H. Höne leg. (genital preparation No. GA—075) (ZFMK); 1 female, same locality as holotype, 27. VI. 1936, H. Höne leg. (ZFMK); 1 female, same locality as holotype, 29. VI. 1938, H. Höne leg. (MUT).

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Zusammenfassung

Die Glasflügler der Gattung *Paradoxecia* Hampson, 1919 werden revidiert. Neben zwei neuen Arten aus Vietnam und SO-China werden die wenig bekannten Arten *P. gravis* (Walker, [1865]) und *P. pieli* Lieu, 1935 neu definiert. Ein Schlüssel erlaubt die Bestimmung aller heute bekannten Arten der Gattung.

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Erster Nachweis einer Strepsipterenparasitierung bei Wanzen in Mitteleuropa (Insecta, Strepsiptera et Heteroptera)

Albert Melber & Hans Pohl

Abstract. In the nature reserve Lüneburger Heide (Lower Saxony, FR Germany) a new Strepsipteran was discovered in 1993 (*Malayaxenos trapezonoti* Pohl & Melber, Strepsiptera, Corioxenidae), which is parasitizing the two ground bug species *Trapezonotus arenarius* (L.) and *T. desertus* Seidenst. (Heteroptera, Lygaeidae). This is the first record of parasitation of Heteroptera by Strepsiptera in Central Europe. First results concerning the univoltine developmental cycle, the biology, and the local distribution of the parasite are presented.

Key words. Insecta, Strepsiptera, Corioxenidae, Heteroptera, Lygaeidae, Northwest Germany, parasitation, life history.

Einleitung

Bei ökofaunistischen Untersuchungen im Bereich des Naturschutzgebietes Lüneburger Heide mit dem Ziel, Auswirkungen landschaftspflegerischer Eingriffe auf die Wirbellosenfauna abzuschätzen, wurden neben anderen Tiergruppen auch Wanzen (Heteroptera) bearbeitet. Bei der Präparation von Bodenfallenmaterial fanden sich in den Abdomina einiger Bodenwanzen (Lygaeidae) neben Dipterenlarven (unbekannte Tachinidae) verschiedene Entwicklungsstadien von Strepsipteren.

Da für Mitteleuropa überhaupt keine Vertreter der Ordnung Strepsiptera mit Heteropteren als Wirte gemeldet sind (Kinzelbach 1978), mußte es sich hier um ein neues Taxon oder um einen Erstnachweis für diesen geographischen Raum handeln. Die Untersuchungen des Strepsipterenmaterials ergab, daß hier eine bisher unbekannte Art vorliegt, die von Pohl & Melber (1996) als *Malayaxenos trapezonoti* beschrieben wurde.

Weil die Auswertung des gesamten Bodenfallenmaterials eine Reihe von Aussagen über die Biologie dieses Strepsipters erlaubt, sind im folgenden alle gewonnenen Daten über den neuen Vertreter dieser biologisch noch sehr unzureichend erforschten Gruppe zusammengestellt.

Untersuchungsgebiete

Die beiden Untersuchungsgebiete „Bockheber" und „Oberhaverbeck" liegen im Naturschutzgebiet Lüneburger Heide (Niedersachsen) 6 km westlich bzw. 10 km nordwestlich von Schneverdingen und sind nur rund 5 km voneinander entfernt (TK-Code mit Minutenfeldangabe: 2825.3/13 bzw. 2825.4/01).

Bei beiden untersuchten Flächen handelt es sich um trockene *Calluna*-Heiden auf Sanduntergrund (Genisto-Callunetum-typicum). Im Gebiet „Bockheber" dominiert überalterte *Calluna*, was ein recht feuchtes Mikroklima in Bodennähe zur Folge hat, im Gebiet „Oberhaverbeck" zeigten sich in den beiden Untersuchungsjahren 1993 und 1994 starke Vergrasungstendenzen mit *Deschampsia flexuosa* (L.) Trin. In beiden Fällen war eine ziemlich dicke Rohhumusauflage vorhanden.

Material und Methoden

Sämtliche untersuchten Wirtstiere stammen aus Bodenfallenfängen. Die Fallen in der Bauweise nach Melber (1987) waren jeweils ganzjährig exponiert und wurden halbmonatlich geleert. Als Tötungsflüssigkeit diente unverdünntes Ethylenglykol. Die gefangenen Tiere wurden nach dem Auslesen des Falleninhaltes in 70%igem Ethanol konserviert. In den Jahren 1993 und 1994 waren im Gebiet „Bockheber" 6 und im Gebiet „Oberhaverbeck" 31 Bodenfallen aufgestellt.

Ergebnisse

In Bodenfallen auf den beiden Untersuchungsflächen „Bockheber" und „Oberhaverbeck" im Naturschutzgebiet Lüneburger Heide wurden in den Jahren 1993 und 1994 zahlreiche Imagines von *Trapezonotus arenarius* (Linnaeus) und *T. desertus* Seidenstücker (Heteroptera, Lygaeidae) gefangen, die mit verschiedenen Entwicklungsstadien des Parasiten *Malayaxenos trapezonoti* Pohl & Melber (Strepsiptera, Corioxenidae) befallen waren.

Aufgrund der relativ großen Anzahl gefundener Parasitierungsfälle können neben der Aussage, daß hier erstmals in Mitteleuropa eine Parasitierung von Wanzen durch Strepsipteren nachgewiesen wurde, auch zahlreiche Angaben zur Biologie des Parasiten gemacht werden.

Morphologische Charakteristika der Parasitierung

Sämtliche Entwicklungsstadien von *Malayaxenos trapezonoti* wurden im Abdomen der Wirtsimagines gefunden. Abgesehen von 2 Männchen, die im verpuppten Zustand vollständig im Inneren des Wirtsabdomens eingebettet waren, wurde nur 1 Männchen gefunden, dessen Cephalothorax in der Weise, wie es bei dieser Strepsipterengruppe üblich ist, intersegmental am Wirtsabdomen ausgebohrt war. Die Austrittstelle war in diesem Fall dieselbe wie bei den zahlreich gefundenen weiblichen Cephalothoraces: immer dorsal zwischen dem 2. und dem 3. sichtbaren Abdominaltergit (morphologisch 3. und 4. Tergit), wo sich eine besonders breite sekundäre Intersegmentalmembran befindet, rechts und links der Abdomenmitte gleich häufig (Abb. 1).

Die Cephalothoraces der Weibchen befanden sich, wie die aller bekannten Corioxeniden, vollkommen unter den Hemielytren des Wirtstieres und sind daher ohne Präparation nicht sichtbar. Eine Begattung durch das Männchen ist wahrscheinlich trotzdem möglich, wobei das Abdomenende des Männchens seitlich um die Flügelvorderkante des Wirtes herumgeführt wird. Dies hat Kirkpatrick (1937) für *Corioxenos antestiae* Blair gezeigt, eine Art, die Pentatomiden der Gattungen *Antestia* und *Antestiopsis* parasitiert, wo ebenfalls die weiblichen Cephalothoraces auf der Abdomenoberseite vollständig unter den Deckflügeln der Wirtstiere liegen.

Entwicklungszyklus von Wirt und Parasit

Bei den beiden Wirtsarten *Trapezonotus arenarius* und *T. desertus* handelt es sich um univoltine Imaginalüberwinterer. In den Untersuchungsgebieten erfolgt die Eiablage nach der Überwinterung ab März, hauptsächlich im April und Mai, Larven treten ab Mitte Mai auf. Erste Imagines der neuen Generation erscheinen in der ersten Junihälfte.

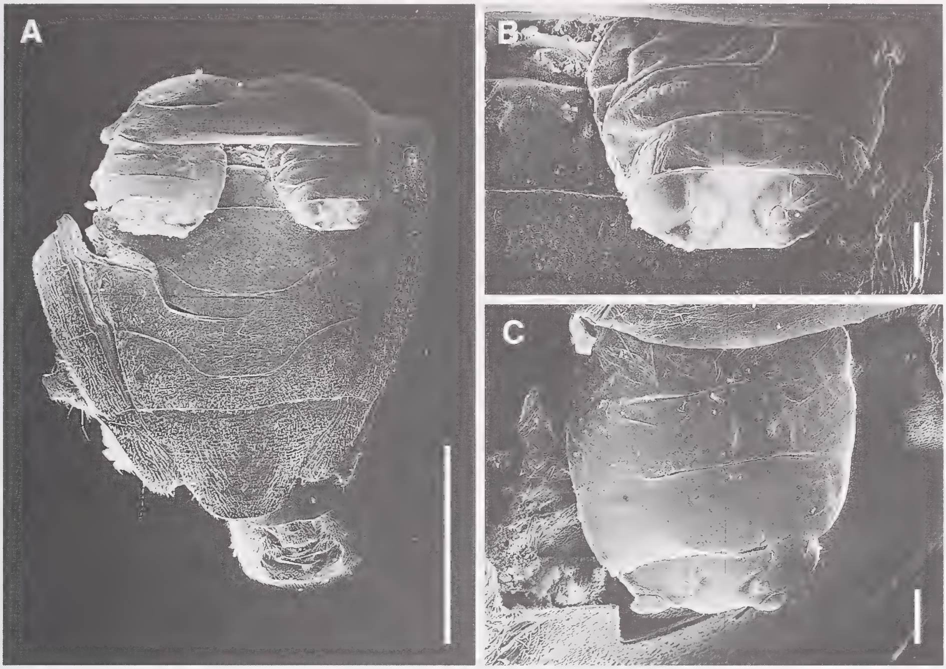

Abb. 1: Rasterelektronenmikroskopische Aufnahme von *Malayaxenos trapezonoti*; A: Abdomen von *Trapezonotus desertus* mit 2 herausgebohrten *Malayaxenos*, links Weibchen, rechts männliches Puparium; B: männliches Puparium; C: Weibchen. Maßstab: A: 1 mm, B, C: 0,1 mm.

Malayaxenos trapezonoti überwintert in den Wirtsimagines als Sekundärlarve. Dieses Entwicklungsstadium war sowohl vor der Winterruhe des Wirtes im August und September als auch danach im März und April in den laufaktiven Wirtsimagines zu finden. Herausgebohrte Parasitenweibchen und -männchen ließen sich dann ab Mitte März bzw. Mitte April nachweisen. Reife Weibchen mit fertig ausgebildeten Primärlarven wurden Mitte Mai bis Mitte Juli festgestellt. Die Primärlarven treffen also bei ihrer Wirtssuche vor allem auf die frisch entwickelten Imagines der neuen Generation, ob sie auch schon in ältere Wirtslarven eindringen, die zu dieser Zeit noch in großer Anzahl vorhanden sind, konnte nicht überprüft werden.

Eine graphische Zusammenfassung der bisherigen Erkenntnisse über den jahreszeitlichen Verlauf der Wirts- und Parasitenentwicklung zeigt die Abb. 2.

Spezifität der Parasitierung

Die beiden Wirtsarten *Trapezonotus arenarius* und *T. desertus* stehen sich taxonomisch sehr nahe; *T. desertus* wurde erst 1951 von *T. arenarius* abgetrennt. Beide Arten sind zwar in ganz Nordwestdeutschland verbreitet, ihre relative Häufigkeit wird aber

deutlich von einem Kontinentalitätsgradienten beeinflußt: In *Calluna*-Sandheiden tritt im Westen (Emsland) nur *T. desertus* auf und erst in Zentralniedersachsen kommt *T. arenarius* in ganz geringen Anteilen hinzu, um dann im Osten (z. B. Umgebung Gifhorn) Anteile um 25 % zu erreichen. Noch weiter im Osten an der Elbe (Wendland) kommt praktisch nur noch *T. arenarius* vor.

In den beiden Untersuchungsgebieten lag 1993/94 das Verhältnis von *T. arenarius* : *T. desertus*-Imagines in Bodenfallen bei 1 : 12,2. Das Verhältnis parasitierter Individuen unter den beiden Lygaeiden-Arten war 1 : 10,0. Da es sich hierbei aber nur um insgesamt 37 Parasitierungsfälle handelt, läßt sich keine signifikante Präferenz für eine der beiden Wirtsarten erkennen.

Andere Lygaeidenarten in den Untersuchungsgebieten, die als potentielle Wirtsarten ebenfalls untersucht wurden (*Macrodema micropterum* Curtis, *Pterotmetus staphyliniformis* Schilling, *Rhyparochromus pini* Linnaeus, *Scolopostethus decoratus* Hahn und *Stygnocoris sabulosus* Schilling), waren nie parasitiert, so daß zumindest eine strenge Gattungsspezifität der Parasitierung vorzuliegen scheint.

Geschlecht des Wirtes und Parasitierung

Daß keine Präferenz des Parasiten für ein bestimmtes Geschlecht der Wirtstiere vorhanden ist, konnte ebenfalls gezeigt werden. Das Geschlechterverhältnis beider *Trapezonotus*-Arten (Männchen zu Weibchen) bei den Bodenfallenfängen insgesamt lag bei 1 : 1,50, bei den parasitierten Tieren bei 1 : 1,57.

Mehrfachparasitierung

Bei 5 der insgesamt 37 untersuchten Parasitierungsfälle lag eine Mehrfachparasitierung vor. 2 *T. desertus*-Männchen und 1 Weibchen waren mit je 2 reifen, dorsal links und rechts herausgebohrten Parasitenweibchen besetzt. In einem *T. desertus*-Weib-

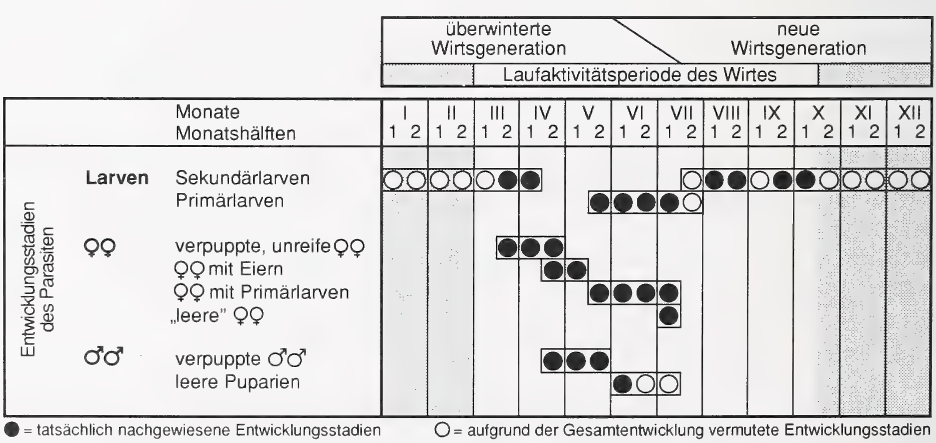

Abb. 2: Jahreszeitliches Auftreten verschiedener Entwicklungsstadien von *Malayaxenos trapezonoti* in Beziehung zum Jahreszyklus der Wirtsarten.

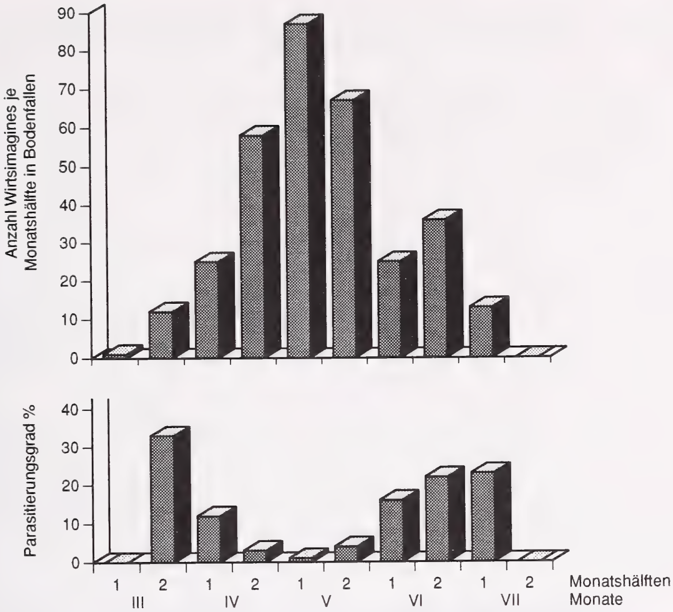

Abb. 3: Beziehung zwischen der Anzahl der insgesamt in Bodenfallen (1993 + 1994 gefangenen Imagines von *Trapezonotus desertus* und *T. arenarius* beider Untersuchungsgebiete und dem Anteil der durch *Malayaxenos trapezonoti* parasitierten Individuen.

chen fand sich neben einem reifen *Malayaxenos*-Weibchen, welches normal dorsal ausgebohrt war, ein verpupptes Männchen im Inneren des Wirtsabdomens. In einem fünften Fall wurde ein *T. desertus*-Weibchen gefunden, welches neben 2 verpuppten Parasitenweibchen noch eine mittelgroße Sekundärlarve enthielt. Offenbar können 2 *Malayaxenos*-Individuen in einem Wirtstier zur vollen Entwicklung gelangen, für 3 Parasiten gleichzeitig reicht dann aber die Nahrungsressource nicht mehr aus.

Einfluß der Parasitierung auf den Wirt

Offensichtlich wird die Laufaktivität des Wirtes, die sich in der Bodenfallenfangrate widerspiegelt, durch die Parasitierung beeinflußt. Das normale jahreszeitliche Muster der Laufaktivität (Abb. 3, oben) zeigt für beide *Trapezonotus*-Arten einen Aktivitätsbeginn im März, ein Maximum in der ersten Maihälfte und ein Ausklingen der Laufaktivität aufgrund des Absterbens der überwinterten Generation Ende Juli. Zu dieser Zeit kommen dann schon wieder Imagines der neuen Generation hinzu (in Abb. 3 nicht dargestellt). Der relative Anteil parasitierter Wirtsindividuen in den Bodenfallen wird aber nun mit ansteigender Bodenfallenfangrate immer geringer (Abb. 3, unten), was nur durch eine reduzierte Laufaktivität solcher Tiere in der 2. Aprilhälfte und im Mai erklärbar ist. Wie der Abb. 1 aufgrund des Auftretens herausgebohrter *Malayaxenos*-Weibchen und dem Vorliegen reifer Männchen zu entneh-

men ist, dürfte dieser Zeitraum die Periode der Kopulation des Strepsipters sein. Zu dieser Zeit sind also die parasitierten Wirtsimagines deutlich weniger laufaktiv als die unparasitierten.

Die Frage, inwieweit die Reproduktionskapazität und Vitalität der Wirtstiere durch die Parasitierung beeinflußt wird, läßt sich nur grob abschätzen. Festzustellen ist, daß in den einfach parasitierten *Trapezonotus*-Imagines die Gonaden nach Ausreifen der Parasiten immer noch teilweise erhalten und aktiv sind. Es wurden bei den reifen Wirtsweibchen neben den Parasiten in der Regel immer noch reife Eier in Teilen des Ovars gefunden; entsprechend verfügten parasitierte *Trapezonotus*-Männchen immer noch über Teile reifer Hoden. Ob solchen Tieren aber noch eine erfolgreiche Kopulation bzw. Eiablage möglich ist, kann nicht beantwortet werden. Bei den Mehrfachparasitierungen waren im Wirtsabdomen keine nennenswerten Organreste mehr zu finden, hier erfolgt also eine vollständige parasitäre Kastration.

Wie die recht hohen Fangraten parasitierter Wirtstiere gegen Ende der Laufaktivitätsperiode (Juni/Juli) zeigen, wird die Lebensdauer der *Trapezonotus*-Imagines durch die Parasitierung nicht nennenswert verkürzt, im Gegenteil könnte sogar eine Seneszenzverzögerung für das Wiederansteigen des Anteils parasitierter Tiere in den Bodenfallen zu dieser Zeit verantwortlich sein.

Regionale Verbreitung von *Malayaxenos trapezonoti*

Um erste Aussagen über die Häufigkeit und Verbreitung von *Malayaxenos trapezonoti* zu ermöglichen, wurde älteres Bodenfallenmaterial aus *Calluna*-Heiden in Niedersachsen, in dem höhere *Trapezonotus*-Fangzahlen auftraten, auf Stylopisierung hin untersucht. Wie die Tab. 1 zeigt, wurden trotz teilweise hoher *Trapezonotus*-Individuenzahlen keine weiteren Standorte mit *Malayaxenos*-Parasitierung gefunden. Sogar in *Calluna*-Heiden, die in enger Nachbarschaft zu den beiden Untersuchungsgebieten mit *Malayaxenos*-Vorkommen liegen, wurde die neue Strepsipterenart nicht nachgewiesen. *Malayaxenos trapezonoti* scheint somit also nur in räumlich sehr engumgrenzten Populationen vorzukommen.

Diskussion

Die bis jetzt vorliegende Auswertung von 2 Bodenfallenjahrgängen von 2 Standorten mit insgesamt 37 Parasitierungsfällen erlaubt natürlich noch keine vollständige Übersicht zur Biologie von *Malayaxenos trapezonoti*. Grundlegende Tatsachen allerdings, wie z. B. das Vorliegen einer univoltinen Entwicklung, können bereits als gesichert gelten.

Etwas unklar bleibt die Lebensweise der Männchen. Insgesamt wurden neben 30 Strepsipterenweibchen nur 4 Männchen (als Puppen oder leere Puparien) nachgewiesen. Bei 2 von diesen Männchen-Funden waren die fertig verpuppten und sklerotisierten Tiere vollständig im Wirtsabdomen eingebettet und der Cephalothorax war nicht herausgebohrt, was bedeutet, daß diese Männchen nicht mehr den Wirt verlassen konnten. Vielleicht befindet sich *Malayaxenos trapezonoti* in einer phylogenetischen Entwicklung in Richtung auf eine Parthenogenese, worauf der stark reduzierte Männchen-Anteil in der Population und das Auftreten gewissermaßen „funktionsloser“ Männchen hindeuten könnte. Andererseits zeigen die beiden anderen Männ-

Tabelle 1: Vorkommen von *Trapezonotus desertus* und *T. arenarius*-Imagines, die von *Malayaxenos trapezonoti* parasitiert waren, in 8 verschiedenen Untersuchungsgebieten in Niedersachsen.

Untersuchungsgebiet (mit TK 25-Code)	Untersuchungsjahr	Anzahl untersuchter Individuen	gefundene Parasitierungsfälle
Tütsberg (2825.3)	1993 + 94	34	0
Bockheber (2825.3)	1993 + 94	208	12
Oberhaverbeck (2825.4)	1993 + 94	197	25
Oberhaverbeck II (2825.4)	1986	47	0
Pietzmoor-Heide (2924.2)	1993 + 94	640	0
Bokeler Heide (3229.1)	1986	93	0
NSG Heiliger Hain (3329.3)	1986 + 87	406	0
Helstorf-Reiterheide (3423.2)	1989 + 90	216	0

chen-Nachweise, daß höchstwahrscheinlich normale Männchen vorhanden sind. Für *Corioxenos antestiae* konnte Kirkpatrick (1937) zeigen, daß 1 Männchen mindestens 12 Weibchen begatten kann, daher reicht ein geringer Männchen-Anteil für eine normale bisexuelle Vermehrung aus.

Da allen hier dargestellten Ergebnissen ausschließlich Bodenfallenmaterial zugrundeliegt, könnte natürlich ein geringerer Männchen-Anteil bei *Malayaxenos* auch durch eine reduzierte Laufaktivität von Wirten, die von männlichen Parasiten befallen sind, zustande kommen.

Danksagung

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Zusammenfassung

An zwei eng benachbarten *Calluna*-Heidestandorten im Naturschutzgebiet Lüneburger Heide wurde 1993 und 1994 bei *Trapezonotus desertus* und *T. arenarius* (Heteroptera, Lygaeidae) erstmals für Heteropteren in Mitteleuropa eine Parasitierung durch Strepsipteren nachgewiesen. Es handelt sich hierbei um *Malayaxenos trapezonoti* Pohl & Melber, 1996 (Strepsiptera, Corioxenidae). Die äußerlichen Charakteristika der Parasitierung werden beschrieben und anhand von 37 Parasitierungsfällen der univoltine Entwicklungszyklus des Parasiten rekonstruiert. Eine Präferenz für eine der beiden Wirtsarten liegt offenbar nicht vor, wie auch nicht für eines der Wirtsgeschlechter. Das Auftreten von Doppel- und Dreifachparasitierung wird

beschrieben. Durch die Parasitierung wird die Laufaktivität der Wirtsimagines, gemessen anhand der Bodenfallen-Fangrate im Zeitraum der Kopulationsflüge von *Malayaxenos trapezonoti*, drastisch reduziert. Eine weitere Auswirkung der Parasitierung ist eine partielle parasitäre Kastration der Wirtsimagines. Die erfolglose Suche nach *Malayaxenos trapezonoti* an anderen *Calluna*-Heidestandorten in Niedersachsen mit individuenreicheren Vorkommen von *Trapezonotus*-Arten zeigt, daß diese Strepsipterenart offenbar nur sehr lokal verbreitet ist.

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Post-eclosion heterochrony in the maturation of the adult females of a termitophilous fly (Diptera, Phoridae)

R. H. L. Disney

Abstract. Many termitophilous adult insects postpone completion of the expansion of parts, such as the head and femora, until long after eclosion from their pupae. Consequently adults of different ages may differ markedly in appearance. Among the Termitoxeniinae the most extreme post-eclosion changes occur in the females of *Clitelloxenia assmuthi* (Wasmann 1902). Documentation of these changes lead to the proposal that five species be synonymised with this species. It has been argued (Assmuth 1913) that the females of this species are likely to ingest haemolymph from the older nymphs of their termite hosts. If so, ingestion of termite-nymph hormones might delay the cessation of expansion and sclerotization of parts of these flies following eclosion. At the least it is concluded that darkening of the cuticle cannot be treated as a reliable indicator of sclerotization. Probably darkening and hardening are decoupled in these flies.

Key words. Diptera, Phoridae, Termitoxeniinae, synonyms, heterochrony, teneral state, Isoptera, Termitidae.

Introduction

Heterochrony is the "dissociation, during development, of factors of shape, size, and maturity, so that organisms mature in these respects at earlier or later growth stages" (Nichols 1989). In evolutionary terms it has been defined as "an evolutionary change in the onset or timing of development of a feature relative to the appearance or rate of development of the same feature in the ontogeny of an ancestor" (Lincoln et al. 1982). It has evidently been a widespread mechanism giving rise to novelty during evolution (Matsuda 1987).

Among termitophilous insects heterochrony tends to manifest itself as a tendency for parts of certain adults to remain in the teneral state for a prolonged period after eclosion from the pupa. A general review of termitophilous insects (Kistner 1982) has shown that heterochrony occurs among termitophilous Carabidae, Cecidomyiidae, Phoridae, Scarabaeidae and Staphylinidae. In this paper a striking case of an Oriental species of Termitoxeniinae (Diptera, Phoridae) is documented and discussed.

This study has been made possible by my access to the extensive collections of termitophilous Phoridae made by Dr David H. Kistner (California State University, Chico) over many years. In addition I am grateful to the following for the loan of type material in their cares: Dr. H. Ulrich, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn; Dr F. N. Dingemans-Bakels, Natuurhistorisch Museum, Maastricht; and Dr B. R. Pitkin, the Natural History Museum, London. I am grateful to my colleague Dr Simon Maddrell for useful discussions. My studies are currently funded by a grant from the Leverhulme Trust, to my colleague Dr William Foster for a Research Associate to work on termitophilous Phoridae, and the Isaac Newton Trust (Trinity College, Cambridge). I am grateful to W. M. Lee (Zoology Department, Cambridge University) for his skilled operation of the Scanning Electron Microscope.

Post-eclosion changes in Termitoxeniinae

The taxonomy of the aberrant termitophilous Termitoxeniinae, of the famly Phoridae, is currently undergoing revision. This follows the realisation that the males, the flying-stage females and flightless-stage females had been erroneously assigned to three separate subfamilies by earlier authors (Disney 1989, 1990, 1992, 1994, Disney & Cumming 1992, Dessart 1993). It had long been recognised that the females undergo post-eclosion changes from a stenogastric to a physogastric stage (e. g. Assmuth 1913, Mergelsberg 1935). It has only recently been realised that the early stenogastric females shed their wing membranes on entering their host-termite's nest (Disney & Cumming 1992). Furthermore the procurement of mating pairs of an Afrotropical species has allowed reconstruction of the complete sequence of changes that occur in the adult females after eclosion. This has prompted a closer look at a taxonomically confused complex of six 'species' assigned to the Oriental genus *Clitelloxenia* Kemner, and a re-evaluation of these species in terms of most being different stages in a series of post-eclosion changes within a single species.

Clitelloxenia assmuthi (Wasmann 1902)

Termitoxenia assmuthi Wasmann 1902: 151. Holotype ♀, INDIA: Khandala, near Bombay (Natural History Museum, Maastricht) [presumed cotype material examined]

Termitoxenia peradeniyae Wasmann 1913: 20. Holotype ♀, SRI LANKA: Peradeniya (Natural History Museum, Maastricht) [examined]. Syn. nov.

Termitoxenia clitellaria Schmitz 1915: 36. Holotype ♀, SRI LANKA: Maha, Illupalama, Anuradhapura (Museum Alexander Koenig, Bonn) [examined]. Syn. nov.

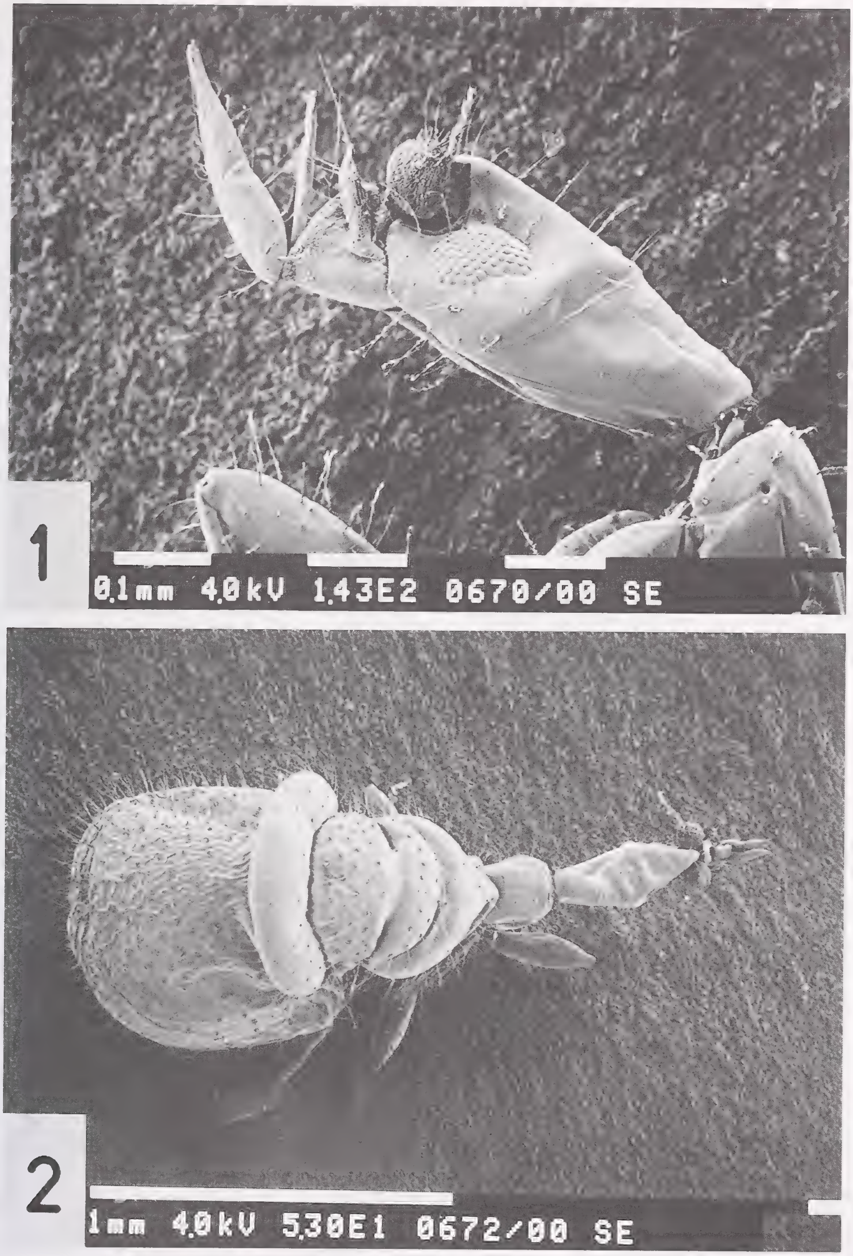
Termitoxenia longiceps Schmitz 1915: 36. Holotype ♂, MALAYSIA: Malacca (Natural History Museum, Maastricht — only two slide-mounted legs survive) [examined]. Syn. nov.

Termitoxenia hemicyclia Schmitz 1931: 176. Holotype ♀, JAVA, Buitenzorg (Museum Alexander Koenig, Bonn and also the Natural History Museum, London — a series of presumed cotypes) [series examined]. Syn. nov.

Clitelloxenia marshalli Schmitz 1938: 35. Holotype ♀, INDIA: Bangalore, Mysore (Museum Alexander Koenig, Bonn — one wing stump; rest in Natural History Museum, London) [examined]. Syn. nov.

A mature physogastric female from Java is shown in Figs 1 and 2. It is postulated that the material treated here as a single species exhibits a more marked degree of post-emergence change than most Termitoxeniinae. It is proposed that a failure to appreciate the extent of these changes in the females has misled early workers into describing as new species specimens which merely represented different stages of species already known. In most cases only limited material was available to these early workers. The larger samples now available, mainly because of the collections made by Dr David Kistner, serve to indicate that there are great differences between flies of different ages within a single sample, but litte, if any, difference between flies of the same age from different samples. There is thus now no doubt that *C. clitellaria* and *C. marshalli* should be treated as synonyms. The small differences highlighted by Schmitz (1916, 1938) clearly lie within the ranges of variation to be found in a single sample of flies from the same termite nest.

The removal of two species by synonymy still leaves us with four 'species', which are based on geographical region — the Indian subcontinent, Sri Lanka, Java and Malaysia. Aggregated samples (of Kistner's material plus specimens in museums)



Figs 1—2: *Clitelloxenia assmuthi* mature physogastric female. 1, lateral view of head, 2, whole fly from above.

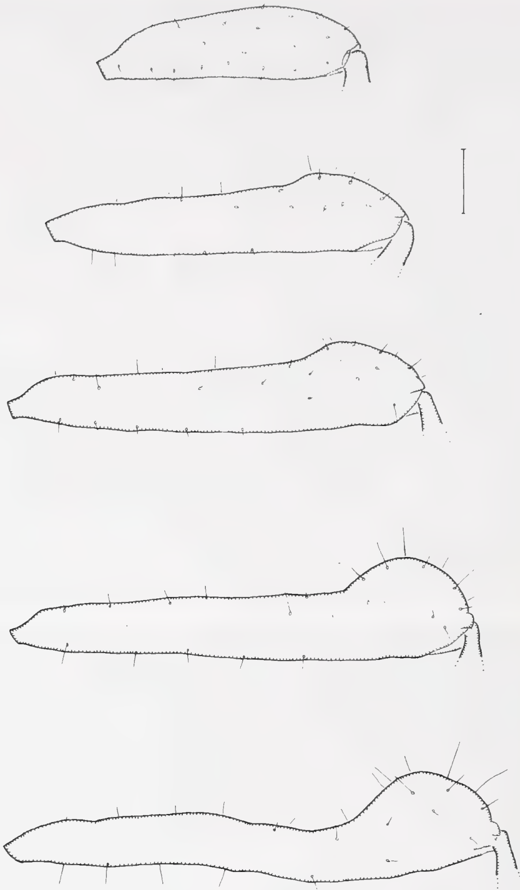


Fig. 3: *Clitelloxenia assmuthi* females, posterior faces of hind femora. The youngest fly at top and oldest below. (Scale bar = 0.1 mm).

from each of these four regions look different from each other. However, this seems to be primarily due to the different age structures of the total sample of specimens available for study from each region. Table 1 presents the length frequencies of the hind femora for females from the four regions. The differences between these aggregated samples for the four regions could be explained by any one of the following hypotheses:

(1) An accident of sampling, such that the aggregated samples from each region happen to represent populations of different ages.

(2) The four regions are characterised by four different taxa, species or subspecies, with different growth characteristics.

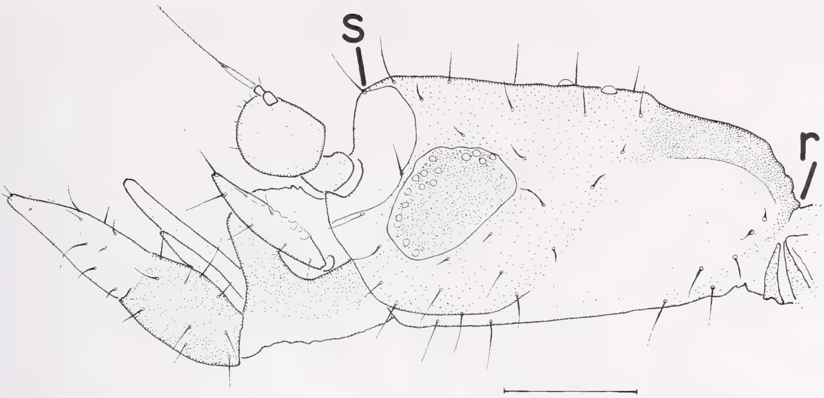


Fig. 4: *Clitelloxenia assmuthi* female, left face of head. s = anterior (lower) supra-antennal bristle; r = rear of head. (Scale bar = 0.1 mm).

(3) A single species is subjected to different phenotypic modifications of its growth characteristics in the different regions, possibly due to different species of *Odontotermes* serving as its hosts in the four regions.

The relationship between age of fly and length of hind femur is indicated by Fig. 3. This shows the hind femora of females from a single sample from a nest of *Odontotermes grandiceps* Holmgren from Bogor, Java (collected by Dr Kistner, 20 June 1977). The fly at the top had two developing eggs only 0.44 mm long, while that at the bottom had a single egg 0.93 mm long. In the topmost specimen the femur is only lightly tinged brown. In the bottom two specimens the femora are dark brown. Furthermore, as indicated by these two specimens, the larger the femur the more likely it is to exhibit distortion of its basic shape. Fig. 4 depicts the head of a female from Sri Lanka. The basiproboscis is seemingly well sclerotized and even more so the occipital region. Fig. 5 depicts the development of the occipital region in a series of females of the same series as for the femora depicted in Fig. 3. In Fig. 6 the ratio of the head length to length of hind femur is plotted for the 82 females of Table 1. The head length was measured from the anterior supra-antennal bristles to the back of the head (Fig. 4). Such a tight scatter of points, along a single straight line, would be highly improbable if the hypothesis of two or more sibling species were to be favoured, to explain the differences in Table 1.

Examination of slide-mounts of females made from the material collected by Dr Kistner, and the measurement of the lengths of the dominant developing oocytes in particular, has allowed certain inferences to be drawn. Typically two oocytes start to develop in the young stenogastric female. In a few cases both mature, eventually attaining a length exceeding 0.8 mm. Typically, however, one ceases to grow as the other starts to become more elongate (e. g. Fig. 7). The oocyte whose development is halted frequently proceeds to degenerate, but in some cases it seems to persist in a healthy but static state. Whether it will resume normal development when the first

Fig. 5: *Clitelloxenia assmuthi* left faces of heads of females of different ages, the youngest at top (from the same series as in Fig. 3). (Scale bar = 0.1 mm).

Table 1: Recorded lengths of the hind femora of samples of females of *Clitelloxenia assmuthi* from different regions.

Region	length in mm					
	0.3–0.4	0.4–0.5	0.5–0.6	0.6–0.7	0.7–0.8	0.8–0.9
India + Pakistan	1	1	10	9	0	0
Sri Lanka	0	5	9	2	0	0
Java	0	2	9	16	4	0
Malaysia	0	0	0	1	11	2
TOTALS	1	8	28	28	15	2

Table 2: Recorded lenths of developing eggs in relation to lengths of hind femora of females of *Clitelloxenia assmuthi* from different regions.

Region	Femur length (mm)	length of developing oocyte (egg) in mm 0.2—0.4	0.4—0.6	0.6—0.8	0.8—1.0 (x)	n	$\frac{10x}{n}$
Pakistan	<0.6	1	6	5	1	13	0.8
Sri Lanka	<0.6	0	1	1	2	4	5.0
Malaysia	<0.6	0	0	0	0	0	0
Java	<0.6	0	0	0	0	0	0
TOTALS	<0.6	1	7	6	3	17	1.7
Pakistan	>0.6	0	0	1	4	5	8.0
Sri Lanka	>0.6	0	0	0	2	2	10.0
Malaysia	>0.6	0	1	1	11	13	8.5
Java	>0.6	0	2	3	8	13	0.62
TOTALS	>0.6	0	3	5	25	33	7.5

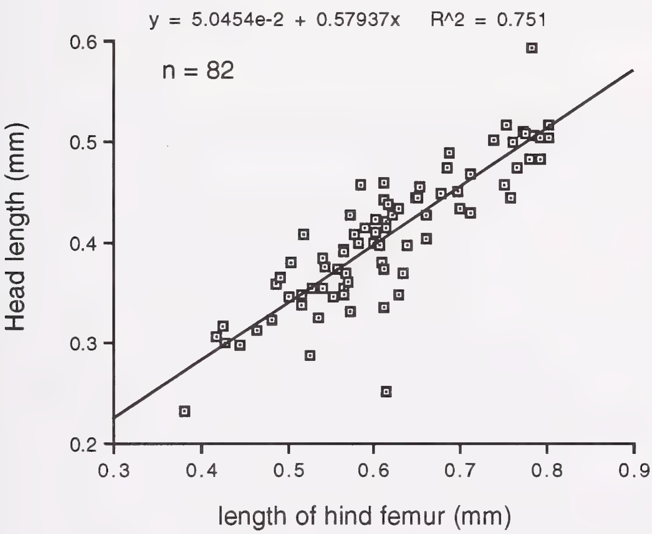


Fig. 6: *Clitelloxenia assmuthi* females, head lengths plotted against lengths of hind femora.

egg has been laid is not known. It needs emphasizing that when flies with oocytes and eggs of different sizes are arranged in order, from smallest to largest, then this correlates with the degree of differentiation of the egg. In flies with the shortest hind femora developing oocytes are not discernible in my slide-mounted specimens. In those with intermediate length femora the contents of the developing oocytes or eggs are little, if any, differentiated. In those with the longest femora not only has the

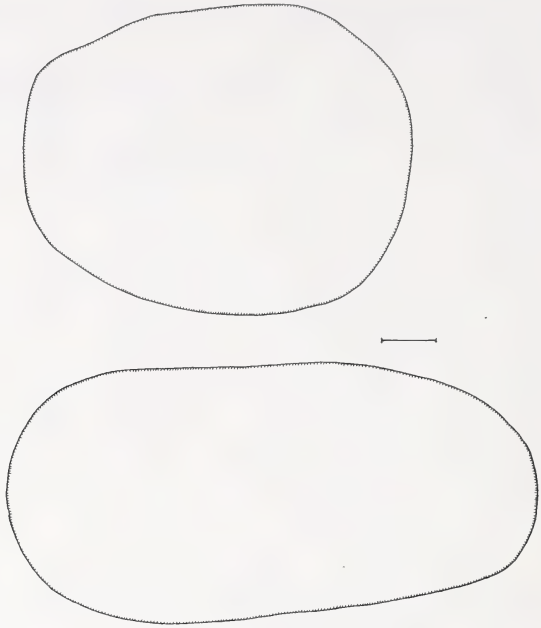


Fig. 7: *Clitelloxenia assmuthi* the two developing oocytes in a single female. The upper oocyte (of the left side) has ceased growing, the lower egg (of the right side) is nearing maturity. (Scale bar = 0.1 mm).

development of one egg halted, but in the other egg there is increasing differentiation of the contents, with the formation of an increasingly distinct chorion. The most mature eggs exhibit very little variation in length. Smaller flies do not have smaller mature eggs than larger flies, they have more immature eggs (which are therefore smaller) than are to be found in larger flies. In a few large flies no developing eggs could be observed. In these cases the appearance of the abdomen suggested that the lack of an egg was probably due to it having been recently laid. Measurements of developing eggs found are presented in Table 2.

The data in Table 2 provide no support for the hypotheses based on assuming that the females in the four regions have different growth characteristics. The most parsimonious conclusion, therefore, is that hypothesis (1) an accident of sampling, is sufficient to explain the differences between the samples from the four regions. Until defensible differences can be demonstrated, therefore, it is proposed to treat the material from the four regions as belonging to a single species, which continues to lengthen its femora and head right up to the oviposition of its first mature egg at least. Thus *C. peradeniyae, C. longiceps* and *C. hemicyclia* are herewith proposed as further synonyms of *C. assmuthi*.

Discussion

Clitelloxenia assmuthi exhibits the most extreme post-eclosion changes in the Termitoxeniinae studied to date. It is perhaps relevant to consider an inference proposed by Assmuth (1913). On the basis of the appearance of the gut contents and the structure of the mouthparts, he suggested that this species probably ingests haemolymph from older nymphs of its termite host. If so, such behaviour would ensure ingestion of hormones prevalent in the blood of these juvenile termites. These termite hormones might then serve to delay cessation of the expansion and sclerotization of the head and femora in these flies.

The continuing growth of the occipital region of the head in *Clitelloxenia assmuthi* after the apparent onset of sclerotization is most surprising. It is certainly evident that the darkening of the femora and occipital region is not correlated with a cessation of growth. At the least this suggests that darkening may be an unreliable indicator of sclerotization. The two familiar indicators of sclerotization, hardening and darkening, may not necessarily be coupled. Indeed it is established that sclerotization sometimes occurs without darkening, as in the case of albino insects (Chapman 1991). It is suggested that in these flies darkening is initiated earlier than hardening. If darkening and hardening are not decoupled in these flies then it would be necessary to postulate some reversal of hardening to allow continuing growth. This would seem most improbable.

Zusammenfassung

Bei manchen termitophilen Insekten wird das Wachstum von Körperteilen, wie Kopf und Femora, erst lange nach der Imaginalhäutung abgeschlossen, mit der Folge, daß Imagines verschiedenen Alters recht verschieden aussehen können. Was die Termitoxeniinae betrifft, wurden die stärksten postmetabolen Veränderungen der äußeren Gestalt bei den Weibchen von *Clitelloxenia assmuthi* (Wasmann 1902) beobachtet. Auf Grund von Korrelation und Häufigkeitsverteilung der Merkmale werden fünf weitere beschriebene Arten als Altersstadien von *C. assmuthi* gedeutet und mit dieser synonymisiert. Assmuth (1913) vermutete, daß die Weibchen dieser Art Hämolymphe von älteren Larven der Wirtstermite saugen. Sollte dies zutreffen, so wäre es denkbar, wenn auch unwahrscheinlich, daß der Abbruch des postmetabolen Wachstums und die Aushärtung der Cuticula durch Wirkung des aufgenommenen Juvenilhormons verzögert werden. Die Melanisierung der Cuticula setzt lange vor dem Stillstand des Wachstums ein und erfolgt demnach offenbar unabhängig von der Sklerotisierung.

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Recognition of a sibling species of the Australian *Eutermiphora abdominalis* Lea (Diptera: Phoridae)

R. H. L. Disney

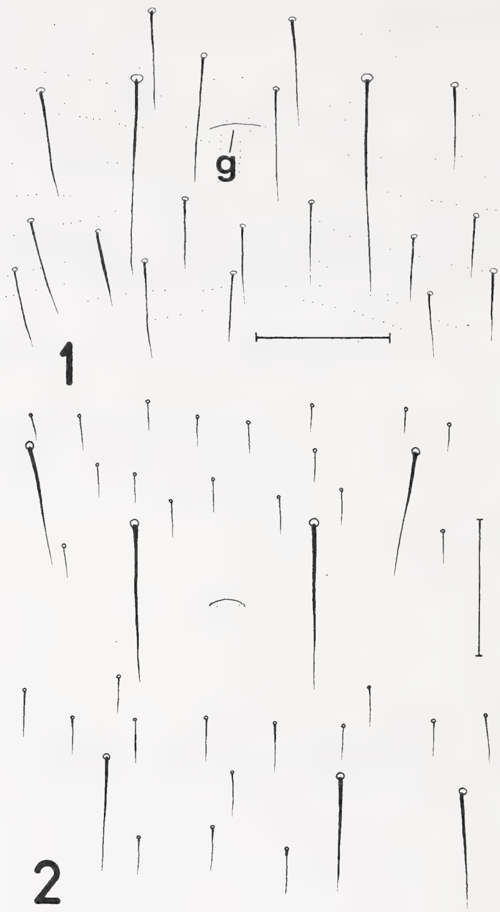
Abstract. *Eutermiphora watsoni* sp. n. is distinguished from the type species of the genus, *E. abdominalis* Lea 1911. The females of both species live in the colonies of *Nasutitermes fumigatus* (Brauer 1865) in New South Wales. The taxonomic significance of the position of the pre-apical setae of the palps is discussed, with particular reference to the problem of the affinities of the Termitoxeniinae.

Key words. Diptera, Phoridae, new species, Isoptera, Termitidae.

Introduction

The aberrant termitophilous genus *Eutermiphora Lea* (1911) (Diptera: Phoridae) was established for a single female from a termite's nest at Sydney, New South Wales, Australia. Unfortunately Lea overlooked both the wing stumps and halteres that, in mature females, are concealed beneath a forward extension of the anterior region of the abdomen that covers much of the thorax. The result was to cause confusion in keys to genera and in attempts to determine the affinities of this genus, apart from its assignment to the Metopininae. Lea's description is very brief and has a single sketchy figure of the whole fly. Beyer's detailed, but turgid, redescription, based on two females from Victoria, is longer but devoid of figures. Furthermore he also overlooked the halteres and wing stumps. Seven females of *Eutermiphora* from a colony of *Nasutitermes fumigatus* (Brauer 1865) at Braidwood, New South Wales, allowed recognition that the mature females retain halteres and wing stumps (it being probable that the young females shed their wing membranes upon entering the termite colony, as with Termitoxeniinae). In the light of this discovery, an illustrated reappraisal of the genus was provided (Disney 1989). On a recent trip to Australia I collected a single female *Eutermiphora* from a colony of *Nasutitermes fumigatus* at Berowra, north of Sydney. On slide mounting this specimen, it proved to be a sibling species of the series from Braidwood. I therefore borrowed the type of *E. abdominalis*. The specimen from Berowra is conspecific. It is concluded that the series from Braidwood constitutes a hitherto unrecognised sibling species. It is named below, its description augmented and its distinction from *E. abdominalis* specified.

The genus *Eutermiphora* is characterised by Disney (1989) and included in the latest key to the genera of the Phoridae of the world (Disney 1994). It is currently only known from mature, flightless-stage, females.



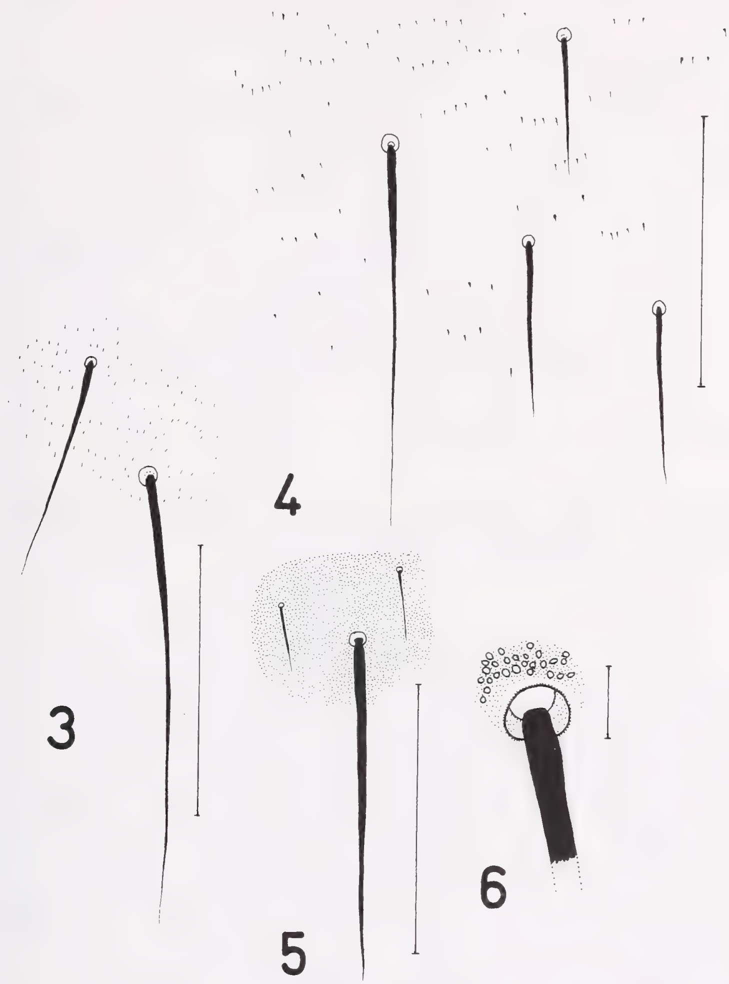
Figs 1—2: *Eutermiphora* females, gland openings (g) at rear of dorsal faces of fifth abdominal segments. 1, *E. watsoni*; 2, *E. abdominalis*. (Scale bars = 0.1 mm).

Eutermiphora abdominalis Lea, 1911

Eutermiphora abdominalis Lea, 1911: 77. Holotype ♀, AUSTRALIA, New South Wales, Sydney (South Australien Museum, Adelaide) [examined].
Beyer, 1966: 214. 2 ♀, AUSTRALIA, Victoria, Echuca, 1. 1. 1936. (National Museum of Victoria, Melbourne) (the specimens appear to have been lost).

Lea (1911) provided a single figure of the whole fly. His holotype is now remounted on a slide. The principal difference from the newly-recognised species is in the hairing and microtrichia of the abdomen (see below). The microtrichia are exceptionally small and densely crowded (Fig. 5). The measurements in Beyer's redescription allow recognition that his specimens belong to this species.

Female (Figs 2, 5, 8, 10—11).



Figs 3—6: *Eutermiphora* females, abdominal hairs and microtrichia on dorsal face. 3, *E. watsoni*, fifth segment; 4, *E. watsoni*, third segment; 5, *E. abdominalis*, fifth segment; 6, *E. watsoni*, base of bristle on segment 3. (Scale bars = 0.1 mm for 3—5 and 0.01 mm for 6).

The host reported for this species by Lea (1911) was *"Eutermes fumipennis"*, now called *Nasutitermes fumipennis* (Walker). However, this species is now known not to occur in Australia and Watson & Gay (1980) suggested that most Australian records of this species were probably really *Nasutitermes exitiosus* (Hill) or, in a few cases, *N. walkeri* (Hill). However, there is a single soldier termite mounted with Lea's holotype of this fly. I have now identified this termite as *N. fumigatus*.

New material examined: ♀, New South Wales, Berowra, 7. VI. 1995 (R. H. L. Disney), in galleries of *Nasutitermes fumigatus* in log.

Eutermiphora watsoni sp. n.

Eutermiphora abdominalis Disney 1989: 435. Misidentification

Female only known (Figs 1, 3—4, 6—7, 9, 12) The figures supplement those given elsewhere (figs 1—5 in Disney 1989, figs 6.1d, 8.46a—b in Disney 1994). This species is a little larger than *E. abdominalis*. The third segment of the arista is at least 0.2 mm long, but is nearer 0.1 mm in *E. abdominalis*. The apical bristle of the palp is longer than the subapical bristle, but is shorter than the subapical in *E. abdominalis*. The hairs of the dorsal face of the abdomen are less sharply divided into two distinct series, of long bristle-like hairs and short hairs. There is a more continuous gradation from long to short hairs (cf Figs 1 and 2). A clear difference is that the microtrichia of the upper faces of abdominal segments 2—6 are much larger and fewer in number (Figs 3—4), only being at all dense in the vicinity of the gland opening (g in Fig. 1) at the rear of segment 5. Especially on segment 2, these microtrichia tend to be arranged in irregular transverse rows (as in Fig. 1). The metatarsi of the front and hind legs are more elongated than those of *E. abdominalis* (Figs 7—10).

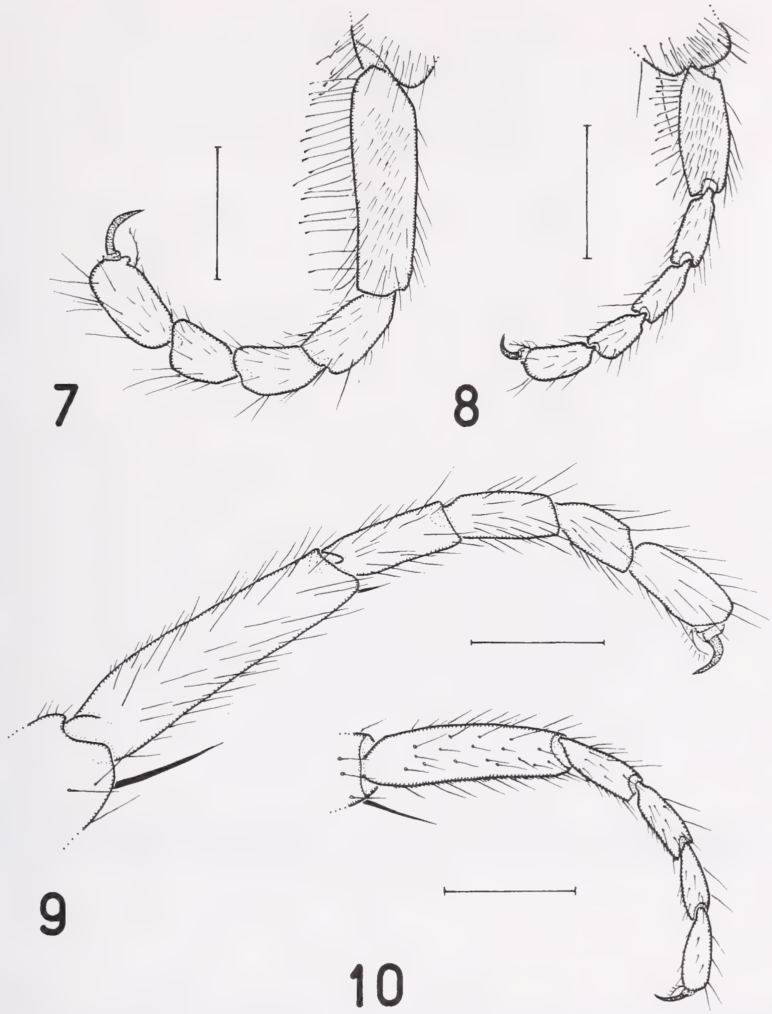
Etymology: The species is named in memory of the late Dr J. A. Watson, who gave me valuable information and publications on Australian termites.

Holotype ♀, AUSTRALIA, New South Wales, about 12 miles west of Braidwood, from nest of *Nasutitermes fumigatus*, 11. V. 1960 (F. J. Gay) (Australian National Insect Collection, CSIRO, Canberra). 6 ♀ paratypes, same data as holotype except three deposited in University Museum of Zoology, Cambridge.

Discussion

The achievement of a satisfactory supra-generic classification of the Phoridae is still a long way off, and is the subject of current controversy. The subfamilies Termitoxeniinae and Thaumatoxeninae are well circumscribed, but their affinities with the rest of the family remain obscure (Disney & Kistner 1992, 1995). The Aenigmatiinae are probably a polyphyletic assemblage reflecting convergent evolution. The largest subfamily, the Metopininae, embraces the probably monophyletic Megaseliini, the almost certainly polyphyletic Beckerinini and the probably paraphyletic Metopinini. The remaining subfamily, the Phorinae, is likewise probably paraphyletic. Brown's (1992) proposals designed to rectify some of these defects have served to highlight the latter. However, the proposals themselves have precipitated current controversies (Disney 1993, 1994, Brown 1995, Disney 1995a, 1996). In view of this I highlight an interesting feature of the genus *Eutermiphora*. The palps carry the pre-apical differentiated setae on the external face (Fig. 12), rather than on the internal face like most Phoridae. The patterns of distribution of these setae in different families and genera is reviewed below.

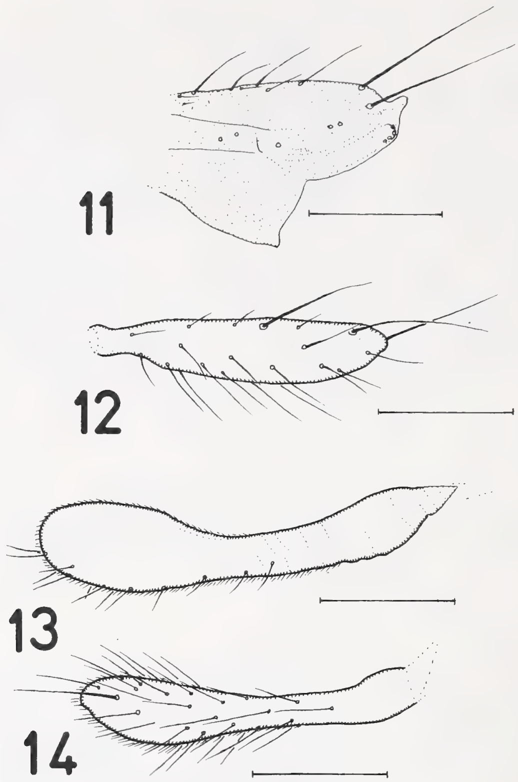
In the Sciadoceridae, the putative sister group of the Phoridae (Cumming et al. 1995), the differentiated setae on the palps are all weak and restricted to the vicinity of the lower margin, but with most being submarginal on the outer face (Fig. 13). In the putative sister group of the Sciadoceridae + Phoridae, the Ironomyiidae, the setae are larger and more numerous and appear to occur on both faces (Figs 1—2 in McAlpine 1967). This is certainly the case in the supposedly related Lonchopteridae, in which the setae are well developed on both faces of the palp, but are more numerous and stronger on the outer face (Fig. 14). In the presumed basal family of the Cyclorrhapha, the Platypezidae, many genera have no differentiated setae on the



Figs 7—10: *Eutermiphora* females, anterior faces of tarsi. 7, *E. watsoni*, front leg; 8, *E. abdominals*, front leg; 9, *E. watsoni*, hind leg; 10, *E. abdominalis*, hind leg. (Scale bars = 0.1 mm).

palps. Others, e. g. *Agathomyia* Verrall, have strongly differentiated setae on the lower margin and inner face of the palp. The related Opetiidae, have no differentiated setae on the palps. In the Empidoidea differentiated setae on the outer face of the palp are common, often with the apical setae further differentiated as bristles. The inner face is typically devoid of differentiated setae.

Taken overall, the above outgroup comparisons suggest that the groundplan state in the Cyclorrhapha is possibly with differentiated setae on the both faces of the palp



Figs 11—14: 11—12: *Eutermiphora* females: 11, *E. abdominalis*, right wing stump; 12, *E. watsoni*, right palp. 13—14: Left palps: 13, *Sciadocera rufomaculata* female; 14, *Lonchoptera lutea* male. (Scale bars = 0.1 mm).

but more strongly on the outer face, with one or more apical or subapical setae further differentiated as stronger setae or bristles. Thus *Lonchoptera* possibly represents the groundplan state.

Within the Phoridae every variety of palp setal pattern is encountered, but most frequently the setae are on the inner face with the apical bristles differentiated in varying degrees. The condition reported for *Eutermiphora* (Fig. 12), therefore, is atypical. However, this pattern is characteristic of all Termitoxeniinae (Disney & Kistner 1995). Furthermore, it occurs in some Metopininae. In most Megaseliini the inner face carries the setae and the apex has differentiated bristles, but in a few species the setae are reduced or lost. In many Metopinini also the pre-apical setae are on the inner face; for example *Chonocephalus* Wandolleck and *Echidnophora* Schmitz. In the case of the latter, this observation reinforces the finding that the resemblance between Termitoxeniinae and *Echidnophora* is due to convergence (Disney 1995b). However, the termitophilous metopinine genera *Bolsiusia* Schmitz

and *Penthaplus* Schmitz, like *Eutermiphora*, have the pre-apical setae on the outer face of the palp, as does the type genus of the Metopinini, *Metopina* Macquart. It is possible, therefore, that this feature is a synapomorphy that unites these genera with the Termitoxeniinae. However, we do not know the extent to which this feature may have evolved independently more than once, and even symplesiomorphy cannot be ruled out.

These observations on palp setal pattern suggest the hypothesis that *Eutermiphora* might be phylogenetically related to the Termitoxeniinae. The female's abdominal physogastry, the shortened costa in relation to the shedding of the wing membranes (presumably at the time of entry to the termite host's nest), the lack of axillary bristles on the wing, the reduction in the size and/or density of the microtrichia on the top of the abdomen and the leg chaetotaxy are additional features of resemblance. The mid-mesopleural ridge and the gland opening at the rear of abdominal segment 5 (g in Fig. 1) distinguish *Eutermiphora* and allow its assignment to the Metopininae. The tapered labella of the proboscis (fig. 2 in Disney 1989) are very similar to those of many Termitoxeniinae. However, this feature is probably not a groundplan feature of the latter subfamily (Disney & Kistner 1995) and so this resemblance most likely represents an example of convergent evolution.

The small, subcircular, features clustered around the bases of some abdominal bristles (Fig. 6) invite further investigation. Fresh specimens examined with the scanning electron microscope should establish whether these features are perforations, thus indicating that the associated bristles are probably primitive solutrichomes that produce a placatory exudate licked up by the host-termite workers (Disney 1995b, Disney & Kistner 1995). So far solutrichome bristles are only known from Termitoxeniinae.

The procurement of the unknown males of *Eutermiphora* would be likely to reveal whether the majority of the similarities between this metopinine genus and Termitoxeniinae are due to affinity or convergence.

Acknowledgements

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Zusammenfassung

Eutermiphora watsoni sp. n. wird von *E. abdominalis* Lea 1911, der bisher einzigen Art und Typusart der Gattung, unterschieden. Die Weibchen beider Arten leben in Kolonien von *Nasutitermes fumigatus* (Brauer 1865) in New South Wales. Die Anordnung der präapikalen Borsten auf den Maxillarpalpen wird als Merkmal erörtert, besonders im Hinblick auf die ungeklärte systematische Stellung der Termitoxeniinae.

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A new species of *Notolaemus* Lefkovitch from Rwanda (Coleoptera: Laemophloeidae)

Michael Karner

Abstract. *Notolaemus wagneri* n. sp. from Rwanda is diagnosed, described and illustrated. Brief notes on the genus *Notolaemus* are given.

Key words. Coleoptera, Laemophloeidae, *Notolaemus*, description, Rwanda.

Introduction

In his study of European Laemophloeinae, Lefkovitch (1959) described the genus *Notolaemus* with two species, *Notolaemus castaneus* (Erichson) and *N. unifasciatus* (Latreille), and mentioned that the genus is also represented in Asia, America, and Africa. Later, Lefkovitch (1962) provided a key to the African Laemophloeidae and recorded eight species of *Notolaemus*. Except for the genus *Cryptolestes* Ganglbauer (which is, because of the economic importance of some species, comparatively well-studied [Thomas 1988], little work has been done on this family since then. It is to be expected, therefore, that the great majority of Laemophloeidae is still undiscovered. A small but very interesting sample of Laemophloeidae and Silvanidae collected near the Akagera National Park, Rwanda, by Thomas Wagner (Bonn), included a new species of *Notolaemus* which is described here.

Notolaemus wagneri n. sp.

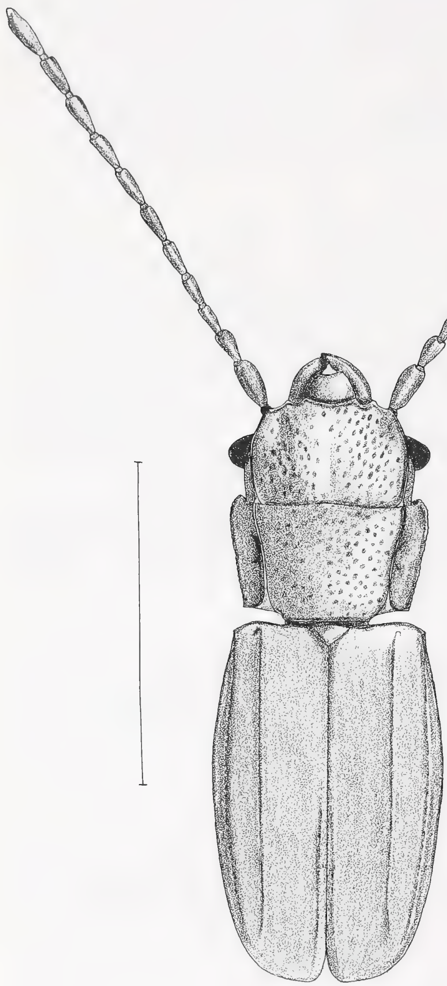
Types: Male holotype in Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn (ZFMK), with following data: "Rwanda, Rusumo / Ibanda Makera, X. / Th. Wagner leg. 93". 9 Paratypes with same data, in ZFMK (1 ♂, 5 ♀) and in the author's collection (1 ♂, 2 ♀).

Diagnosis

Notolaemus wagneri n. sp. is similar to *N. liganus* Lefkovitch and *N. perspicuus* (Grouvelle), it can be differentiated from *N. liganus* by greater body length (see Discussion), longer antennae, and from both species by its more prominent, irregularly rounded eyes and by the structure of the male genitalia.

Description

Length 1.63—2.00 mm, body flattened, moderately shining, testaceous; habitus as in fig. 1. Head transverse, length (from apical margin of clypeus at its middle to imaginary line between hind margins of eyes) 0.30—0.39 mm, width (across eyes) 0.45—0.65 mm, width : length = 1.45—1.70; dorsal surface of head near antennal insertions and along median line shallowly impressed. Eyes prominent, irregularly rounded. Front margin of head with flat antennal and deeper mandibular emarginations, labral emargination evenly rounded. Clypeus emarginate anteriorly, with distinct microreticulation. Disc of head shining, almost impunctate medially, laterally punctate, puncture diameter 1.5—2.0 times that of eye facet and punctures separated by on an average their diameter, pubescence very fine, setae about as long as



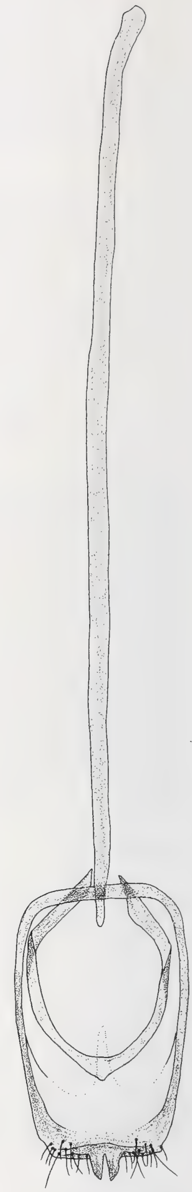


Fig. 1: Habitus of *Notolaemus wagneri* n. sp. (scale line 1 mm).

Fig. 2: Male genitalia of *Notolaemus wagneri* n. sp. (holotype, scale line 0.25 mm).

puncture diameter; surface between punctures somewhat uneven, on lateral parts of head with indistinct microreticulation.

Antennae long and slender, length 1.00—1.43 mm, reaching almost three quarters of body length in males, in females a little shorter, about 0.6 times as long as body. Ratios of length of antennomeres I—XI as: 1:0.6:0.7:0.6:0.75:0.8:0.85:0.8:0.85:0.9:1.15 (male holotype), or 1:0.6:0.5:0.55:0.5:0.6:0.6:0.55:0.7:0.7:1 (female paratype).

Pronotum transverse, length 0.31—0.43 mm, width 0.46—0.63 mm, width : length = 1.35—1.56; broadest at apical fourth in males, at apical third or somewhat closer to the midpoint in females; posterior angles obtuse, anterior angles acute, rectangular; lateral margin very slightly crenulate. Sublateral lines consisting of internal groove and basally broadened raised ridge. A longitudinal impression located laterad to sublateral line at about midpoint of pronotum.

Puncture size as on head, punctures separated by about 1—2 times their diameter; surface between punctures shining, with sparse microsculpture consisting of very fine and short lines (magnification 80 times).

Elytra evenly curved laterally, length (measured along suture, including scutellum) 0.95—1.2 mm, width (across maximum joint width) 0.60—0.75 mm, length : width = 1.50—1.63. Humerus with small, tooth-like projection, sutural stria present only on apical half of elytra, elytral cells I and II absent, cell III impressed basally, only inner stria extending apically, lateral carina complete.

Male genitalia as in fig. 2.

Derivatio nominis: Dedicated to Thomas Wagner, collector of the new species.

Variation: In a single female paratype, two rounded impressions near the pronotal base on both sides of the inner third are present. No further differences to the other specimens at hand could be observed, so this may be a unique deformation.

Discussion

The study of the holotype and six paratypes of *Notolaemus liganus* showed that the body length ranges from 1.35 to 1.55 mm (using a calibrated ocular micrometer), differing considerably from the data according to Lefkovitch (1962). Lefkovitch (1962) described the sublateral lines on the pronotum of *Notolaemus* as represented by raised ridges. Nevertheless, the sublateral lines of both *N. liganus* and *N. wagneri* n. sp. consist of a raised ridge and an internal groove. The transverse sectional view of the pronotum of *N. clarus* (Grouvelle) given by Lefkovitch (1962) also shows distinct internal grooves.

The genus *Notolaemus* seems to be composed of some species — groups whose systematic positions are far from clear. Lefkovitch (1962) stated that the African species *Notolaemus picinus* (Grouvelle) belongs to what he called "*unifasciatus* group", whereas the other African species are closer to *N. castaneus*. However, the comparison of e. g. *N. liganus* with *N. castaneus* hardly reveals greater similarity than there is between *N. castaneus* and *N. unifasciatus*. Any division of the genus *Notolaemus* into subgenera or even species groups is obviously premature until much more work has been done especially on tropical species.

Acknowledgements

The author would like to thank Dr. N. Berti (Museum National d'Histoire Naturelle, Paris) and Dr. E. De Coninck (Musee Royal de l'Afrique Centrale, Tervuren) for the loan of types, Dr. Th. Wagner (Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn) for the opportunity to study his material, and Christine Ott (Frankfurt am Main), Dr. D. Burckhardt (Geneva), Bernd Franzen (Cologne), and Dr. M. C. Thomas (Gainesville) for reading and criticizing the manuscript.

Zusammenfassung

Notolaemus wagneri, eine neue afrikanische Laemophloeide, wird diagnostiziert, beschrieben und abgebildet. Die Zusammensetzung der Gattung *Notolaemus* wird kurz diskutiert.

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Collembola Poduromorpha from the Magallanes Province (Chile)

Wanda M. Weiner & Judith Najt

Abstract. In this paper we present a study of a collection of *Collembola Poduromorpha* from the south of Chile. We determined a total of 15 species. Two new species were described; another species already known from Chile was redescribed, and some complementary characters were added for three other species.

Key words. *Collembola, Poduromorpha,* new species, Magallanes Province, Chile.

Introduction

The Chilean Province Magallanes as well as the Argentinean Tierra del Fuego are very interesting for a scientist because they belong to the Araucarian-Antarctic biogeographic region (Rapoport 1968, 1971). *Collembola* were studied there by Schäffer already in 1897. In continuation, other authors published some works on the *Collembola* of that region. Among the most important papers concerning *Collembola Poduromorpha* are Wahlgren (1906), Enderlein (1912), Rapoport & Rubio (1968), Izarra (1971), Najt (1973), Rubio (1974).

In this paper we present a study of a collection of *Collembola* collected in Barber's traps by Dr. M. Vogel (Akademie für Naturschutz und Landschaftspflege, Laufen, Germany) during his field studies in this region.

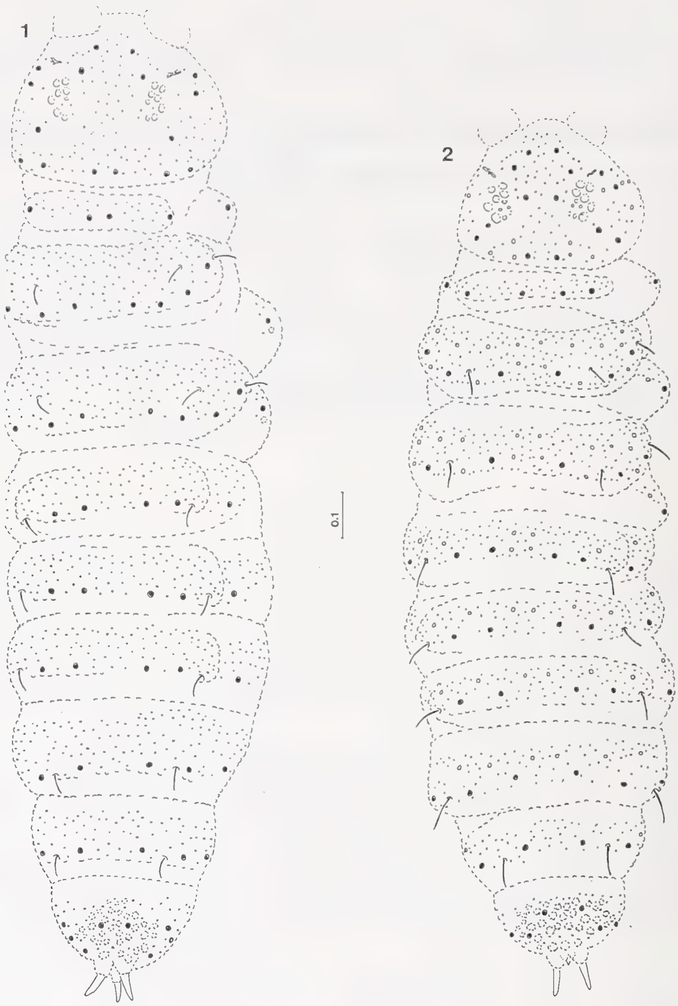
The type material studied in this paper is deposited in the Institute of Systematics and Evolution of Animals, the Polish Academy of Sciences, Kraków (ISEA) and in the Laboratoire d'Entomologie, Muséum national d'Histoire naturelle, Paris (MNHN).

Systematic account

Hypogastruridae

Hypogastrura purpurescens (Lubbock, 1867)

Material: Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a.s.l., Barber's traps, 23 January — 6 February 1985, leg. M. Vogel: low peat-bog of *Sphagnum fimbratum* with *Gunnera magellanica, Carex atropicta, Carex capitata, Carex curta* and *Agrostis flavicola* (L.PAR–1), 20 specimens on slides and numerous specimens in alcohol; wet bottom of a valley, sloping towards a stream with the most important plants as *Gunnera magellanica, Blechnum pennamarina, Acaena magellanica, Carex curta, Carex atropicta, Poa pratensis, Festuca rubra, Trisetum cernum, Arenatherum* sp. (L.PAR–2), 19 specimens on slides and numerous specimens in alcohol; mixed forest of *Nothofagus antarctica* and *Nothofagus pumilio,* about 80 years old, in the understorey: *Gunnera magellanica, Empetrum rubrum, Chilotrichum diffusum, Senecio acantifolius* (L.PAR–3), 19 specimens on slides and numerous specimens in alcohol; patch of an old *Nothophagus pumilio* forest (about 500 years old), large proportion of dead wood, understorey with *Berberis ilicifolia, Rubus cheoides, Acaena magellanica* and *Hierochloe redolens* (L.PAR–4), 12 specimens on slides and numerous specimens in alcohol. Chabunco, about 15 km east of Puenta Arenas, near main road to Puerto Natales, Patagonian steppe, Barber's traps, 6—19 February 1985, leg. M. Vogel:



Figs 1—2: Schema of dorsal chaetotaxy. Fig. 1 — *Triacanthella najtae*. Fig. 2 — *Triacanthella vogeli* sp. n. (Scales in mm).

mesic grassland, vegetation consisting of *Festuca gracilima, Agropyron* spp., *Agrostis* spp., *Deschampsia* spp. and *Poa* spp. (CHA–1), 2 specimens; shrub steppe, peculiarly developed upon former dunes near the coast, vegetation with *Berberis buxifolia, Lepidophyllum cupressiforme, Baccharis magellanica* and new growth of *Nothofagus antarctica* (CHA–2), 3 specimens. Navarino Island, Puerto Williams, 55°10' South, 69°30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: forest of *Nothofagus pumilio*, about 20 m a. s. l., understorey sparse, with *Acaena ovalifolia* and *Viola magellanica* (NAV–1), 4 specimens on slides and some specimens in alcohol; peat-bog of *Sphagnum magellanicum*, about 30 m a. s. l., with *Marsippospermum grandiflorum, Rostkovia magellanica, Carex magellanica* and on the edges dwarfed *Nothofagus betuloides* (evergreen) (NAV–2), 2 specimens; mixed forest with *Nothofagus pumilio* (deciduous) and *Nothofagus betuloides* (evergreen), about 50 m

a. s. l., no understorey, only seedlings (new growth) of *Nothofagus pumilio*, on the forest edge single *Baccharis magellanicus* (NAV–3), 18 specimens on slides and some specimens in alcohol.

Hypogastrura assimilis (Krausbauer, 1898)

Material: Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a. s. l., Barber's traps, 23 January — 6 February 1985, leg. M. Vogel: low peat-bog of *Sphagnum fimbratum* with *Gunnera magellanica, Carex atropicta, Carex capitata, Carex curta* and *Agrostis flavicola* (L.PAR–1), 1 specimen. Navarino Island, Puerto Williams, 55° 10' South, 69° 30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: mixed forest with *Nothofagus pumilio* (deciduous) and *Nothofagus betuloides* (evergreen), about 50 m a. s. l., no understorey, only seedlings (new growth) of *Nothofagus pumilio*, on the forest edge single *Baccharis magellanicus* (NAV–3), 1 specimen.

Ceratophysella bengtssoni (Agren, 1904)

Material: Navarino Island, Puerto Williams, 55° 10' South, 69° 30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: mixed forest with *Nothofagus pumilio* (deciduous) and *Nothofagus betuloides* (evergreen), about 50 m a. s. l., no understorey, only seedlings (new growth) of *Nothofagus pumilio*, on the forest edge single *Baccharis magellanicus* (NAV–3), 3 specimens.

Comments: This species, described from Sweden, has very large Holarctic distribution. The data presented here are the first account from the Neotropical region. All morphological characters are similar to those of European specimens, including the variability described by Thibaud (1967) for French specimens, and also by Christiansen & Bellinger (1980) for North-American specimens.

Xenylla subcavernarum Gama, 1969

Material: Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arena, 250 m a. s. l., Barber's traps, 23 January — 6 February 1985, leg. M. Vogel: low peat-bog of *Sphagnum fimbratum* with *Gunnera magellanica, Carex atropicta, Carex capitata, Carex curta* and *Agrostis flavicola* (L.PAR–1), 1 specimen; wet bottom of a valley, sloping towards a stream with the most important plants as *Gunnera magellanica, Blechnum penna-marina, Acaena magellanica, Carex curta, Carex atropicta, Poa pratensis, Festuca rubra, Trisetum cernum, Arenatherum* sp. (L.PAR–2); 1 specimen, mixed forest of *Nothofagus antarctica* and *Nothofagus pumilio*, about 80 years old, in the understorey: *Gunnera magellanica, Empetrum rubrum, Chilotrichum diffusum, Senecio acantifolius* (L.PAR–3), 5 specimens on slides and some specimens in alcohol; patch of an old *Nothofagus pumilio* forest (about 500 years old), large proportion of dead wood, understorey with *Berberis ilicifolia, Rubus cheoides, Acaena magellanica* and *Hierochloe redolens* (L.PAR–4), 6 specimens on slides and some specimens in alcohol. Navarino Island, Puerto Williams, 55° 10' South, 69° 30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: forest of *Nothofagus pumilio*, about 20 m a. s. l.,, understorey sparse, with *Acaena ovalifolia* and *Viola magellanica* (NAV–1), 2 specimens on slides and some specimens in alcohol; peat-bog of *Sphagnum magellanicum*, about 30 m a. s. l., with *Marsippospermum grandiflorum, Rostkovia magellanica, Carex magellanica* and on the edges dwarfed *Nothofagus betuloides* (evergreen) (NAV–2), 2 specimens on slides and some specimens in alcohol; mixed forest with *Nothofagus pumilio* (deciduous) and *Nothofagus betuloides* (evergreen), about 50 m a. s. l., no understorey, only seedlings (new growth) of *Nothofagus pumilio*, on the forest edge single *Baccharis magellanicus* (NAV–3), 4 specimens on slides and some specimens in alcohol; evergreen forest of *Nothofagus betuloides*, 80 m a. s. l., large fraction of dead wood, no understorey, *Blechnum magellanicum* in small, wet depressions (NAV–4), 2 specimens on slides and one specimen in alcohol.

Triacanthella najtae Izarra, 1971

Material: Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a. s. l., Barber's traps, 23 January — 6 February 1985, leg. M. Vogel: wet bottom of a valley, sloping towards a stream with the most important plants as *Gunnera magellanica, Blechnum penna-marina, Acaena magellanica, Carex curta, Carex atropicta, Poa pratensis, Festuca rubra, Trisetum cernum, Arenatherum* sp. (L.PAR–2), 4 specimens on slides and one specimen in alcohol. Navarino Island, Puerto Williams, 55°10' South, 69°30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: mixed forest with *Nothofagus pumilio* (deciduous) and *Nothofagus betuloides* (evergreen), about 50 m a. s. l., no understorey, only seedlings (new growth) of *Nothofagus pumilio*, on the forest edge single *Baccharis magellanicus* (NAV–3), 2 specimens on slides and some specimens in alcohol.

Comments: For comparison with *T. vogeli* sp. n. we enclose the pattern of the dorsal chaetotaxy (Fig. 1). The dorsal chaetotaxy of *T. najtae* is composed of smooth mesochaetae and crenaleted short macrochaetae. The formula of macrochaetal chaetotaxy per half tergite and subcoxa or pleurite is the following: 8 / 2+1, 4+2, 4+2, / 2+1, 2+1, 2+1, 3+0, 4.

Triacanthella vogeli sp. n.

Holotype: female (ISEA), data: Chile, Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a.s.l., Barber's traps, 23 January — 6 February 1985, leg. M. Vogel: mixed forest of *Nothofagus antarctica* and *Nothofagus pumilio*, about 80 years old, in the understorey: *Gunnera magellanica, Empetrum rubrum, Chilotrichum diffusum, Senecio acantifolius* (L.PAR–3). Paratypes: 8 specimens on slides (5 in ISEA, 3 in MNHN), 820 specimens in alcohol (720 in ISEA, 100 in MNHN), the same data as the holotype.

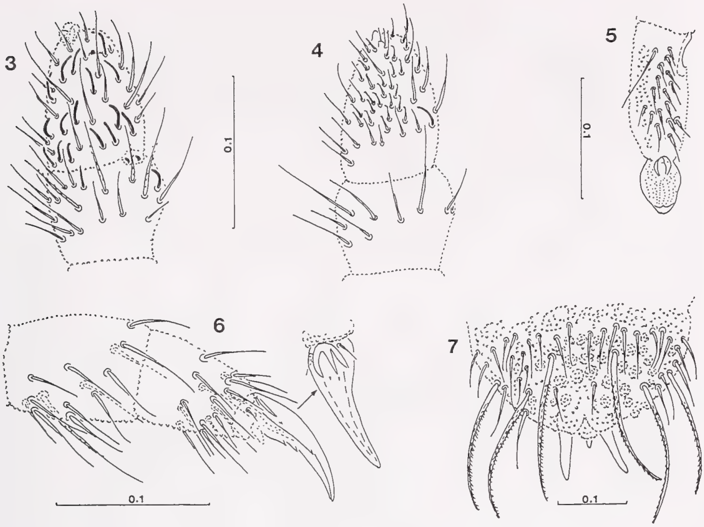
Other material: Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a. s. l., Barbar's traps, 23 January — 6 February 1985, leg. M. Vogel: low peat-bog of *Sphagnum fimbratum* with *Gunnera magellanica, Carex atropicta, Carex capitata, Carex curta* and *Agrostis flavicola* (L.PAR–1), 6 specimens on slides and numerous specimens in alcohol; wet bottom of a valley, sloping towards a stream with the most important plants as *Gunnera magellanica, Blechnum pennamarina, Acaena magellanica, Carex curta, Carex atropicta, Poa pratensis, Festuca rubra, Trisetum cernum, Arenatherum* sp. (L.PAR–2), 3 specimens on slides and some specimens im alcohol; patch of an old *Nothofagus pumilio* forest (about 500 years old), large proportion of dead wood, understorey with *Berberis ilicifolla, Rubus cheoides, Acaena magellanica* and *Hierochloe redolens* (L.PAR–4), 4 specimens on slides and some specimens in alcohol. Navarino Island, Puerto Williams, 55°10' South, 69°30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: evergreen forest of *Nothofagus betuloides*, 80 m a. s. l., large fraction of dead wood, no understorey, *Blechnum magellanicum* in small, wet depressions (NAV–4), 2 specimens on slides and some specimens in alcohol.

Description: Holotype: female length 2.2 mm, length of paratypes between 1.3 and 2.4 mm. Colour in alcohol: white. Tegumental grain of large size, abdominal segment VI with cuticular ornamentation constituted by rosette-shaped tubercles formed by secondary granules (Fig. 7).

Antennal segment I with 10—13 setae, II with 14—17 setae. Sensory organ of antennal segment III consisting of two small hammer-shaped sensillae, two guard sensillae, and one ventro-lateral microsensilla (Figs 3—4). Antennal segment IV with trilobated apical vesicle, small subapical "organite", one dorso-external microsensilla and 16 subcylindrical sensillae (Fig. 3). Ventral side of antennal segment IV with reduced sensory rasp consisting of about 18 modified setae and one subcylindrical sensilla in ventro-lateral position (Fig. 4).

8 + 8 ocelli, of which two (G and H) are reduced. Postantennal organ with 4 unequal vesicles covered by two tegumentary folds. Buccal cone, maxillae and mandibles typical for the genus.

Tibiotarsi I, II, III with 19—20, 19—20, 18 acuminated setae. Claw with two basal inner teeth, one small, basal external tooth and 1 + 1 latero-distal teeth; basis of external lamella with a tridentate structure of pseudonychia-type. Presence of rudimentary empodial appendage (Fig. 6).



Figs 3—7: *Triacanthella vogeli* sp. n. Fig. 3 — antennal segment III and IV, dorsal side. Fig. 4 — antennal segment III and IV, ventral side. Fig. 6 — leg III and dorsal side of claw. Fig. 7 — abdominal segment VI, dorsal side.

Ventral tube with 9 + 9 setae. Tenaculum with 3 + 3 teeth. Dens without apical lobe, adult specimens with 15—17 setae, preadult specimens with 13—16 setae, juvenile specimens with 10—11 setae; all specimens have one long, smooth seta at the base, all other setae are ciliated (Fig. 5). Mucro as in Fig. 5.

Dorsal chaetotaxy with mesochaetae of two types: smooth and ciliated, with very long ciliated macrochaetae and sensory setae as in Fig. 2. Macrochaetal chaetotaxy per half tergite and subcoxa or pleurite: 8 / 2+1, 3+1, 3+1, / 2+1, 2+1, 2+1, 3+0, 3+0, 3.
Abdomen VI with three anal spines of which posterior one is very short (Fig. 7).

Discussion: *Triacanthella vogeli* sp. n. is very similar to two species from Argentina: *T. andina* Cassagnau & Rapoport, 1962 from Neuquén (Lago Frias and Nahuel Huapi) and *T. najtae* Izarra, 1971 from Tierra del Fuego and Isla de Los Estados. These three species share the following characters: presence of rosette-shaped tubercles on abdomen VI, shape of claw and rudimentary empodial appendage, reduction of two ocelli (G and H). The new species differs from the two others by the absence of apical lobe on the dens and very short posterior anal spine. Further differences concern the type of macrochaetae (in *T. andina* they are only ciliated in the distal half; in *T. najtae* they are only crenelated and short, in *T. vogeli* sp. n. they are ciliated at the whole length) and formula of macrochaetal chaetotaxy (in *T. andina* per half tergite and subcoxa or pleurite = 7 / 2,3,3, / 4,4,4,4,3,4 — after Cassagnau & Rapoport, 1962, in *T. najtae* = 8 / 2+1, 4+2, 4+2, / 2+1, 2+1, 2+1, 3+0, 3+0, 4 and in *T. vogeli* sp. n. = 8 / 2+1, 3+1, 3+1 / 2+1, 2+1, 2+1, 3+0, 3+0, 3).

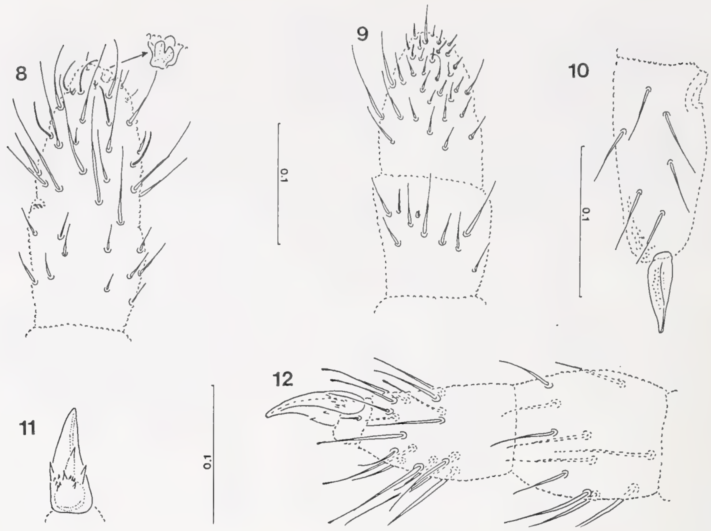
Derivatio nominis: The new species is dedicated to our colleague, Dr. M. Vogel.

Neanuridae

Frieseinae

Friesea sp.

Material: Navarino Island, Puerto Williams, 55°10' South, 69°30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: peat-bog of *Sphagnum magellanicum*, about



Figs 8—12: *Brachystomella ronderosi.* Fig. 8 — antennal segment III and IV, dorsal side. Fig. 9 — antennal segment III and IV, ventral side. Fig. 10 — furca. Fig. 11 — dorsal side of claw. Fig. 12 — leg III.

30 m a. s. l., with *Marsippospermum grandiflorum, Rostkovia magellanica, Carex magellanica* and on the edges dwarfed *Nothofagus betuloides* (evergreen) (NAV-2), 3 specimens.

Comments: It is a new species but we had only juvenile specimens at our disposal and therefore could not describe it in this paper. This species belongs to the group of *Friesea* species with 8 + 8 ocelli, furca absent (stage 5), 4 spiniformes setae of abdominal segment VI and some capitated setae on the body.

Brachystomellinae

Brachystomella ronderosi Najt, 1973

Material: Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a. s. l., Barber's traps, 23 January — 6 February 1985, leg. M. Vogel: low peat-bog of *Sphagnum fimbratum* with *Gunnera magellanica, Carex atropicta, Carex capitata, Carex curta* and *Agrostis flavicola* (L.PAR-1), 5 specimens on slides and numerous specimens in alcohol; wet bottom of a valley, sloping towards a stream with the most important plants as *Gunnera magellanica, Blechnum pennamarina, Acaena magellanica, Carex curta, Carex atropicta, Poa pratensis, Festuca rubra, Trisetum cernum, Arenatherum* sp. (L.PAR-2), 8 specimens on slides and numerous specimens im alcohol.

Comments: In 1973 Najt described this species from Isla de Los Estados. We enclose here some important figures: chaetotaxy of body (Fig. 13), dorsal and ventral side of antennal segments III and IV (Figs 8—9), leg III (Figs 11—12) and furca (Fig. 10).

Setanodosa fueguensis Najt, 1973

Material: Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a. s. l., Barber's traps, 23 January — 6 February 1985, leg. M. Vogel: wet bottom of a valley, sloping towards a stream with the most important plants as *Gunnera magellanica, Blechnum pennamarina, Acaena magellanica, Carex curta, Carex atropicta, Poa pratensis, Festuca rubra,*

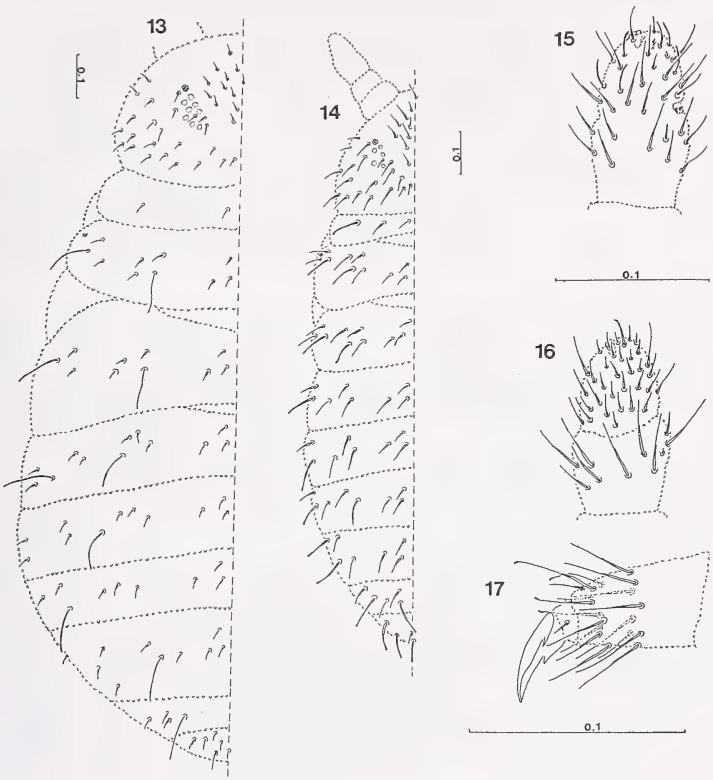


Fig. 13: *Brachystomella ronderosi*, dorsal chaetotaxy.

Figs 14—17: *Setanodosa fuenguensis*. Fig. 14 — dorsal chaetotaxy. Fig. 15 — antennal segment III and IV, dorsal side. Fig. 16 — antennal segment III and IV, ventral side. Fig. 17 — leg. III.

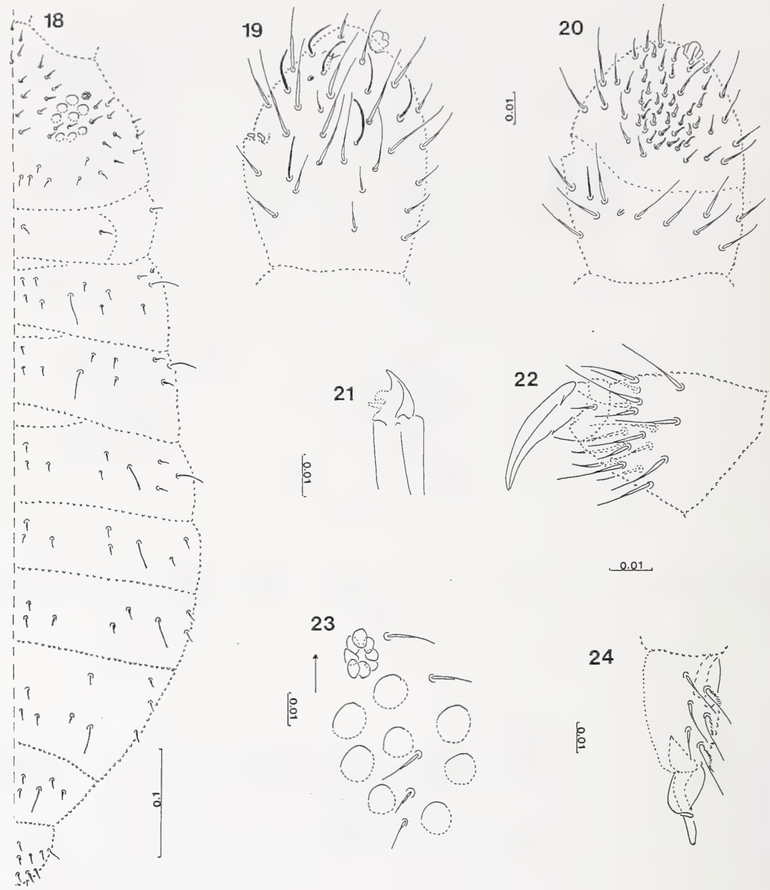
Trisetum cernum, Arenatherum sp. (L.PAR-2), 12 specimens on slides and numerous specimens im alcohol.

Comments: This species, described from Bahia Suceso on Tierra del Fuego, seems to be numerous in this region. We compared our specimens from Laguna Parillar with the holotype. In the present paper some details are given: chaetotaxy (Fig. 14), dorsal and ventral side of antennal segments III and IV (Figs 15—16) and leg III (Fig. 17).

Brachystomellides navarinensis sp. n.

Holotype: male (ISEA), data: Chile, Navarino Island, Puerto Williams, 55°10' South, 69°30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: evergreen forest of *Nothofagus betuloides*, 80 m a.s.l., large fraction of dead wood, no understorey, *Blechnum magellanicum* in small, wet depressions (NAV-4). Paratypes: 8 specimens on slides (6 in ISEA, 2 in MNHN), 48 in alcohol (38 in ISEA, 10 in MNHN), the same data as the holotype.

Other material: Navarino Island, Puerto Williams, 55°10' South, 69°30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: forest of *Nothofagus pumilio*, about 20 m



Figs 18—24: *Brachystomellides navarinensis* sp. n. Fig. 18 — dorsal chaetotaxy. Fig. 19 — antennal segment III and IV, dorsal side. Fig. 20 — antennal segment III and IV, ventral side. Fig. 21 — maxilla. Fig. 22 — leg III. Fig. 23 — postantennal organ and ocelli. Fig. 24 — furca.

a. s. l., understorey sparse, with *Acaena ovalifolia* and *Viola magellanica* (NAV–1), 4 specimens on slides and some specimens in alcohol. Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a. s. l., Barber's traps, 23 January — 6 February 1985, leg. M. Vogel: low peat-bog of *Sphagnum fimbratum* with *Gunnera magellanica, Carex atropicta, Carex capitata, Carex curta* and *Agrostis flavicola* (L.PAR–1), 6 specimens on slides and some specimens in alcohol; mixed forest of *Nothofagus antarctica* and *Nothofagus pumilio*; about 80 years old, in the understorey: *Gunnera magellanica, Empetrum rubrum, Chilotrichum diffusum, Senecio acantifolius* (L.PAR–3), 5 specimens on slides and some specimens in alcohol.

Description: Holotype: male length 0.85 mm, length of paratypes: males and females between 0.79 and 1.0 mm, juvenile specimens 0.5 and 0.58 mm. Colour in alcohol: grey-blue. Tegumental grain middle sized.

Antennal segment I with 7 setae, II with 12 setae. Sensory organ of antennal segment III consisting of two small hammer-shaped sensillae, two guard sensillae, of which dorsal one is

longer than ventral one, and one ventro-lateral microsensilla (Figs 19—20). Antennal segment IV with considerable trilobated apical vesicle, subapical "organite", one dorso-lateral microsensilla, only 6 fine sensillae, of which 3 are in dorso-external position and 3 dorso-internal position, and normal setae blunt at the top (Fig. 19). Ventral side of antennal segment IV with sensory rasp consisting of about 30—32 modified sensory setae and some normal blunt setae (Fig. 20).

8 + 8 ocelli. Postantennal organ with 8 fine granulated vesicles (Fig. 23).

Buccal cone short. Globular maxillary head with apical tooth and basally with two hyaline lobes (Fig. 21). Mandible absent.

Femur ventrally with one very long seta and some short ones. Tibiotarsi I, II, III with 19, 19, 18 acuminated setae. Claw with one inner tooth and a pair of large lateral teeth at the base (Fig. 22).

Ventral tube with 3 + 3 setae. Tenaculum with 3 + 3 teeth. Dens dorsally with 6 setae, of which 3 are thick and ciliated (Fig. 24). Mucro as in Fig. 24.

Dorsal chaetotaxy as in Fig. 18. Formula of sensory setae per half tergite = 0/022/21111.

Discussion: The new species differs from three other species of this genus by the presence of 8 vesicles in postantennal organ (in *B. compositus* Arlé, 1959 = 4, in *B. micropilosus* Cassagnau & Rapoport, 1962 = 17—22 and in *B. neuquensis* Cassagnau & Rapoport, 1962 = 13—17 vesicles). The presence of three thick, ciliated setae on the dens and the maxilla with one apical tooth and two hyaline lobes is characteristic only for the new species.

Pseudachorutinae

Delamarellina guilleni Rapoport & Rubio, 1963

Material: Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a.s.l., Barbar's traps, 23 January — 6 February 1985, leg. M. Vogel: mixed forest of *Nothofagus antarctica* and *Nothofagus pumilio*, about 80 years old, in the understorey: *Gunnera magellanica, Empetrum rubrum, Chilotrichum diffusum, Senecio acantifolius* (L.PAR-3), 2 specimens: patch of an old *Nothophagus pumilio* forest (about 500 years old), large proportion of dead wood, understorey with *Berberis ilicifolia, Rubus cheoides, Acaena magellanica* and *Hierochloe redolens* (L.PAR-4), 1 specimen.

Redescription: Female: length 4.5 mm, length of young specimens: 1.6—1.8 mm. Colour in alcohol: dark grey-blue. Body flattened dorso-ventrally with projecting paratergits. Abdomen VI in ventral position. Tegumental grain medium-sized. Plurichaetotic chaetotaxy strongly developed.

Antennae III and IV fused dorsally, ventrally distinctly separated. Ratio of antenna IV: antenna III = 3.3 (ventral side). Sensory organ of antennal segment III consisting of two small sensillae bent in the same direction, two long guard sensillae fine and subcylindric, of which dorsal one is 1.2 times longer than ventral one, and one ventral microsensilla. Dorsal guard sensilla and two small sensillae of sensory organ of antennal segment III at the base of apical half of antennal segment III + IV (Fig. 28). Ventral guard sensilla and ventral microsensilla on ventral part of distinct antennal segment III (Fig. 29). Dorsal side of antennal segment IV with trilobated apical vesicle, distinct bilobated subapical "organite", small dorso-external microsensilla and 17 short, thick subcylindrical sensillae, all in apical position (Fig. 28). Ventral side with large sensory rasp as in Fig. 29.

Ocelli 5 + 5. Postantennal organ absent.

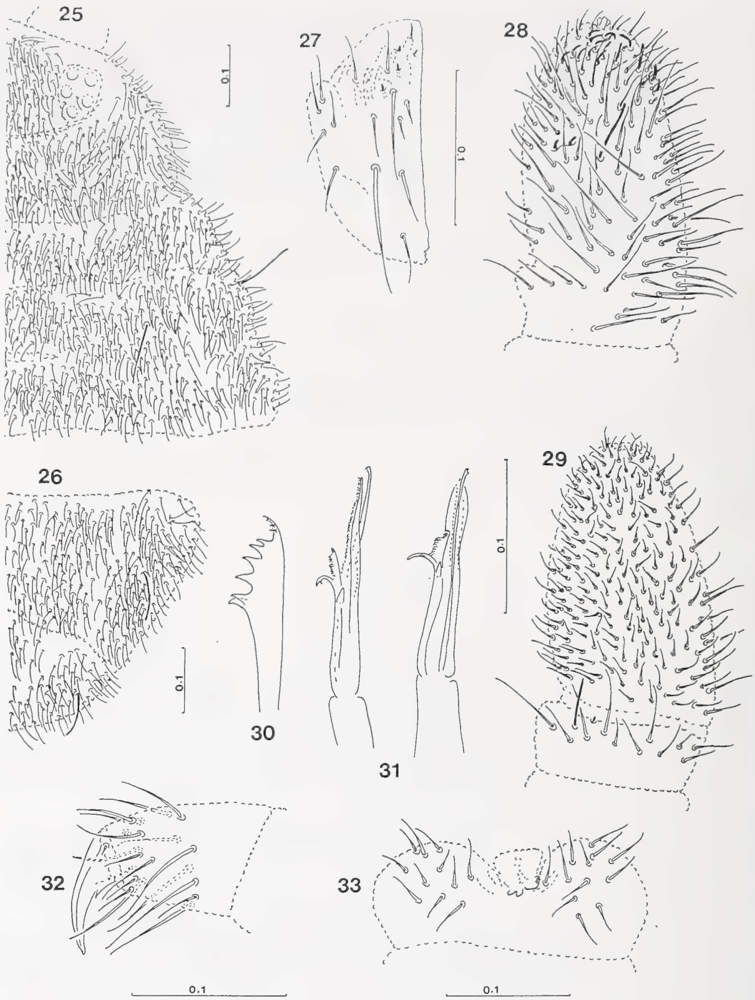
Buccal cone short. Labium with seta L and 4 labial "organite" (x) as in Fig. 27. Mandible and maxillae as in Figs 30—31.

Tibiotarsi I, II, III with 19, 19, 18 acuminated setae. Claw with one inner basal tooth (Fig. 32).

Ventral tube with about 30 + 30 setae. Tenaculum with 2 + 2 teeth, without seta on the corpus. Dens reduced, globular, with 11—12 setae, mucro absent (Fig. 33).

Dorsal chaetotaxy of head, thorax I, II, abdomen IV and V as in Figs 25—26. Body setae short, only sensory setae long.

Comments: This species was described by Rapoport & Rubio (1963) from El Roble Mountains in Chile. In this paper a new redescription is given, including some additional



Figs 25—33: *Delamarellina guilleni*. Fig. 25 — dorsal chaetotaxy of head, thorax I and II (preadult specimen). Fig. 26 — dorsal chaetotaxy of abdomen IV and V (preadult specimen). Fig. 27 — labium, right side. Fig. 28 — antennal segment III and IV, dorsal side. Fig. 29 — antennal segment III and IV, ventral side. Fig. 30 — mandible. Fig. 31 — maxillae. Fig. 32 — leg III. Fig. 33 — furca.

characters. The adult specimen (female) is bigger than specimens from El Roble, but we consider it as the same species. In 1962 Cassagnau & Rapoport described *Arlesia globulosa* as found in Patagonia in Argentina, which is now placed in the same genus *Delamarellina* Rapoport & Rubio, 1963. *D. guilleni* differs from *D. globulosa* (Cassagnau & Rapoport, 1962) particularly by the shape of maxillary head, absence of mucro and tenaculum with only 2 + 2 teeth (3 + 3 in *D. globulosa*).

Onychiuridae

Tullbergiinae

Tullbergia bisetosa Börner, 1903

Material: Navarino Island, Puerto Williams, 55°10' South, 69°30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: forest of *Nothofagus pumilio*, about 20 m a. s. l., understorey sparse, with *Acaena ovalifolia* and *Viola magellanica* (NAV–1), 2 specimens; evergreen forest of *Nothofagus betuloides*, 80 m a. s. l., large fraction of dead wood, no understorey, *Blechnum magellanicum* in small, wet depressions (NAV–4), 1 specimen.

Tullbergia trisetosa (Schäffer, 1897)

Material: Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a. s. l., Barber's traps, 23 January — 6 February 1985, leg. M. Vogel: wet bottom of a valley, sloping towards a stream with the most important plants as *Gunnera magellanica, Blechnum pennamarina, Acaena magellanica, Carex curta, Carex atropicta, Poa pratensis, Festuca rubra, Trisetum cernum, Arenatherum* sp. (L.PAR–2), 2 specimens; patch of an old *Nothofagus pumilio* forest (about 500 years old), large proportion of dead wood, understorey with *Berberis ilicifolia, Rubus cheoides, Acaena magellanica* and *Hierochloe redolens* (L.PAR–4), 1 specimen.

Mesaphorura yosii (Rusek, 1967)

Material: Navarino Island, Puerto Williams, 55°10' South, 69°30' West, Barber's traps, 26 January — 2 February 1985, leg. M. Vogel: evergreen forest of *Nothofagus betuloides*, 80 m a. s. l., large fraction of dead wood, no understorey, *Blechnum magellanicum* in small, wet depressions (NAV–4), 1 specimen.

Comments: Cosmopolitan species.

Dinaphorura sp.

Material: Brunswick Peninsula, Laguna Parillar ca 70 km west of Punta Arenas, 250 m a. s. l., Barber's traps, 23 January — 6 February 1985, leg. M. Vogel: mixed forest of *Nothofagus antarctica* and *Nothofagus pumilio*, about 80 years old, in the understorey: *Gunnera magellanica, Empetrum rubrum, Chilotrichum diffusum, Senecio acantifolius* (L.PAR–3), 1 specimen.

Comments: It is a new species but we had only one specimen (male) at our disposal and therefore could not describe it in this paper. This species belongs to the group of *Dinaphorura* species with the pseudocellar formula per half tergite: 11/011/11111 and two anal spines and 5 spiniformes projections. It differs from the other species of this group by its chaetotaxy.

Acknowledgements

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Resumé

Dans ce travail nous étudions une collection de Collemboles Poduromorphes du sud de Chili. Nous avons déterminé 15 espèces. Nous décrivons deux espèces nouvelles. Nous redécrivons une autre espèce déjà connue du Chili et nous ajoutons des caractères complémentaires pour trois autres espèces.

Zusammenfassung

Bericht über eine Aufsammlung von Collembolen aus dem Süden von Chile. 15 Arten wurden identifiziert. Zwei Arten werden als neu und eine wenig bekannte Art genauer beschrieben; zusätzliche Merkmale werden für drei weitere Arten benannt.

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On the evolution of anthophilous Nitidulidae (Coleoptera) in tropical and subtropical regions

A. G. Kirejtshuk

Abstract. Independent appearance of anthophagy among different nitidulid groups is considered. Circumstances and regular ways of this process are traced and explained. Similar correlations in transformations of structures, trophics and mode of life among anthophagous forms from not related groups are shown. *Propetes* (*Propetes*) *aquilus* sp. n., *P.* (*P.*) *seychellensis* sp. n., *P.* (*Mandipetes*) *intritus* subgen. et sp. n., *P.* (*M.*) *longipes* subgen. et sp. n., *Brounthina aequalis* gen. et sp. n., *Caplothorax* subgen. n. and *Plapennipolus* subgen. n. in the genus *Carpophilus, Urocarpolus* subgen. n. in the genus *Nitops* stat. n. are described and proposed.

Key words. Anthophagy, specialisation, Nitidulidae, phylogeny, taxonomy.

Introduction

This paper is based on a report read at the International Symposium on Biodiversity and Systematics in Tropical Ecosystems held on the 2—6 May 1994. Because of a necessity to add some taxonomical comments which had increased the text more than twice, the final version of the paper was submitted for publication separately from the proceedings of the symposium.

The anthophagy of beetles has drawn the attention of entomologists of many generations. There are a lot of publications on the importance of the anthophagy of beetles in the evolution of the higher plants, though there are few references where a possibility of reciprocal influence in coevolutionary interconnections between coleopterous groups and plants is regarded. The influence of plant food on the insects does not look so markedly in the results of phylogeny of the order Coleoptera in contrast with that of the angiosperm plants and therefore it is not considered to deserve any special investigation. The anthophagy of coleopterous adults and their larvae is usually studied without any link in the formation of these types of feeding, and a certain regularity in trophic transformation is as yet missed from consideration.

The Nitidulidae are a comparatively young family including many groups where we can find a considerable resemblance in transformations of structures, trophics and mode of life showing some more or less evident correlations. Such correlations are especially significant among some Nitidulid groups each of which independently became anthophagous (Kirejtshuk 1994a). Moreover, among the anthophilous Nitidulidae distributed in tropical and subtropical regions the regularities here under consideration are more obvious than in subpolar territories.

The Mesozoic Cucujoidea (including Nitidulidae) are only known from the Cretaceous. According to Dmitriev & Zherikhin (1988) the evident Cleroidea, Tenebrionoidea and Chrysomeloidea as well as extinct Parandrexidae with unclear position

appeared at least no later than the Jurassic. The true Nitidulidae together with other Cucujoid families have been found in different layers of the Cretaceous increasing in number to the end of this period (Ponomarenko 1983; Kirejtshuk & Ponomarenko 1990). If such a distribution in a certain sense reflects dynamics of the appearance of different coleopterous groups, in contrast to a widespread opinion, we are forced to assume that the Cucujoidea had risen no earlier but rather much later than Tenebrionoidea and Chrysomeloidea became distinctly recognisable groups to be identified in fossils. Diversification of the Cucujoidea seemed to arise and be proceeding when the characteristic mesozoic groups of plants became more and yet more rare until they were dislodged by the newly appeared angiosperm plants. Thus the evolution of the Cucujoidea is, perhaps, associated with the development of the Kainophytic flora, even in case this coleopterous group could take its origin somewhat earlier. Interconnections between the Cucujoidea and Kainophytic plants were initially mediated through fungi, and at the end of Cretaceous closer and more intimate interconnections seemingly began to establish at first with generative organs of both the gymnosperms and angiosperms and further on with other plant organs.

Some years ago a hypothesis on the most possible ways of transitions of beetles to feeding and breeding on living vegetative organs of the higher plants from initial (xylo) mycetophagy was proposed (Kirejtshuk 1989). According to it such transitions had an intermediate stage of feeding and breeding on the pollen and other parts of the generative plant organs. Appearance of complete (i.e. imaginal and larval) anthophagy or carpophagy is a rather important point for understanding the development of many phytophagous beetles which gave by present a wide scope of various trophic types. Primary formation of stable trophic connections with the generative plant organs opened a perspective for further expansion on other plant organs to the beetles.

When anthophagy arises, a special selective regime should be adhered. Essential component of this regime is some coincidence of insect development with the flowering period, i.e. the time of existence of available food and habitat. Not infrequent deviations in the time of maturation cause some advantages for the forms with a more rapid development. Acceleration of development is a more or less necessary attribute, which can be interpreted as an adaptation especially important for insects which acquire feeding and breeding in angiosperm flowers with a very short period of anthesis. This acceleration is accompanied by minimization in body size (or so-called miniaturization), and in the sequel with some pedomorphic transformations in imaginal structures as well as with desembryonization of larvae. Inhabitance of larvae inside or near concentrated food resource induces an inactive mode of life facilitating, in turn, desembryonization of larval development. The adaptive tendencies of the forms living in flowers and gymnospern cones are the same. It is possible to observe a convergent similization between the representatives of the Jurassic Parandrexidae (Kirejtshuk 1994b) and some extant *Propetes* from the Epuraeinae here described. That allows to postulate a syndrome of anthophagization at least for the infraorder Cucujiformia (including Chrysomeloidea).

A more common type of interactions between beetles and flowers or gymnosperm male cones looks like a simple feeding of insect adults on pollen. Many authors argue the cantharophilous theory considering that such interactions are unilateral or even

negative for any specimen of flowering plants. However we must admit a participation of beetles in the pollination of plants, including the participation of species whose larvae are not associated with plants. Imagines visited flowers occur among almost all Nitidulid subfamilies (except Calonecrinae, Amphicrossinae and Cybocephalinae). But an obliging attendance of imagines in generative plant organs with larval development in other localities is known among some representatives from the Epuraeinae and Nitidulinae.

One of the ways of acquiring generative plant organs can be observed in the mode of life of *Brachypeplus barronensis* Blackburn, 1902 connected with cycad *Macrozamia communis* in the temperate and subtropical rainforests of Eastern Australia. Imagines and larvae of this Nitidulid species inhabit the apex of cycad trunks between bases of young leaves and inside both male and female cones of this cycad. Together with the Nitidulids some coccids and pseudococcids live in the same places which yield a lot of sweet exudation which, in turn, give a good resource for growing yeast. The larvae and imagines of *Brachypeplus* feed on these fungi and the spores lavishly produced during a comparatively long period by male cycad cones. Inhabitance of the coccids in cycad cones is rather usual at present as it was in the past (Tang 1987). Joint life of beetles and Homoptera in cones of the plants could be an initial stage of transition to regular pollinophagy (or spermatophagy).

The second example gives the mode of life of Australian *Brachypeplus kemblensis* Blackburn, 1902 which inhabits inflorescences of *Alocasia macrorrhyza* from the Araceae (Shaw & Cantrell 1983). The inflorescence of this plant is presented with a long spadix, the basal part of which is covered with a rather big leaf sheet, restricting the free moving of insects in the middle of the spadix inside the inflorescence. Only flat and small beetles (Nitidulid *Brachypeplus kemblensis* and one Omaliinae species) can easily get in and out. At a certain stage of development of these inflorescences the apical staminate part of the spadix begins to decay assisted by the fungus *Fusarium* producing a substrate for developing dipteran and coleopterous larvae. Larvae of Omaliinae, perhaps, act mainly as predators of dipteran larvae (Neurochaeta), but larvae of *Brachypeplus* feed on both pollen and fungi in soft decaying spadix.

A classic example for the development of anthophagy is a mode of life of the Nitidulid *Neopocadius* and Oxycorinid *Hydnorobius* in flowers of the parasitic Neotropical plant *Prosopanche* from the Hydnoraceae (Bruch 1923). According to the opinion of Fegri and van der Peil (1982) the flowers of Hydnoraceae have some resemblance to the bisexual cones of Cycadeoides from the Bennettitales in the hard lignificated outer side as well as in the soft parenchyma of the inner side of these flowers. Moreover, Delevoryas (1968) admitted a considerable similarity also in the character of the holes perforated by insects in both species of plants (extinct and present).

After recent studies it is possible to trace independent transition on the angiosperm flowers and gymnosperm cones of some groups from the *Aethina*-complex of Nitidulinae genera, which includes 9 taxa: *Neopocadius, Brounthina* gen. n., *Idaethina, Anister, Olliffura*, subgenus "*A*", *Aethina, Circopes, Ithyra*. Some aspects of relations between these taxa we can see in fig. 1. The only species of *Neo-*

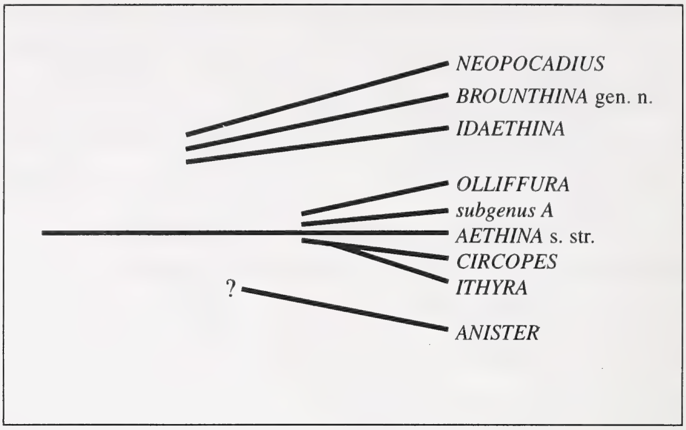


Fig. 1: Composition and tentative relations of the *Aethina*-complex of genera.

pocadius has been mentioned above. *Brounthina aequalis* gen. et sp. n. from New Zealand is known from imagines labelled without bionomical data. Representatives of *Anister* from the Afrotropical and Cape regions, and also from Mediterranean and Indochina are exclusively anthophagous in imaginal stage and miners in larvae. Some endemic Australian species of *Idaethina* feed and breed inside seed capsules of *Brachychiton* (Sterculiaceae), and others are connected with seeds of plants from the Proteaceae. The rest groups of the *Aethina*-complex of genera can be divided into two pairs of taxa (*Olliffura* and subgenus "*A*", on the one hand, and *Circopes* and *Ithyra*, on the other hand) especially close to *Aethina* s. str., linking both pairs. The subgenus *Olliffura* is distributed only in the Indo-Malayan, Australian and Papuan regions. Both larvae and imagines of this subgenus live in flowers of the Malvaceae (mainly *Hibiscus*). The subgenus "*A*" includes only 4 species (3 of them remaining undescribed: 1st — from Himalayas and Indochina, 2d — from Sulawesi, 3d — from Australia, 4th — New Hebrides; for now there is no information on their bionomy). The *Ithyra* species occur in the Afro-Madagascarean regions, one of them recorded from Yemen and Sicilia. Species of this group are connected with flowers of Acantaceae. The subgenus *Circopes* is composed of species from different regions of the Eastern Hemisphere (including Australia), though in the Palaearctic region the habitat of this group does not extend beyond the Palaearctic or East-Chinese subregion. Imagines of some *Circopes* species visit both flowers and tree fungi, others have been collected only on blossoming plants, and others show adherence to inflorescences of monocotylodonous plants or cones of cycads where their larvae develop. Finally, the subgenus *Aethina* s. str. has the widest distribution (except a main part of the Holarctic regions, as well as Australian, Papuan, Polynesian and Patagonean regions). Many species of the last group are in all active stages of their living circle connected with substrates decaying with an assistance of fungi, including soft fruits of angiosperms, but some species of it visit blossoming plants, and *Aethina tumida* can breed in stores of pollen and honey in nests of the domestic honey bee.

Thus, feeding on living plants has been independently acquired at least by 5 groups of this genera complex: 1. *Neopocadius*, 2. *Idaethina*, 3. *Anister*, 4. *Olliffura*, 5. *Circopes-Ithyra*. Anthophagy in the *Olliffura* species was establishing, perhaps, with the separation of this group from *Athina* s. str. or later (in case we get to know that the subgenus "*A*" species are not anthophagous). Anthophagy of *Circopes* and *Ithyra* appeared when their common ancestor had been secluded from the *Aethina* s. str. as some of them preserve an adherence to fungi. Larval mining and imaginal anthophagy of *Anister* is correspondent with the stage next after complete anthophagy in my scheme of probable ways of trophic transformation. The complete (imaginal and larval) carpophagy of the *Idaethina* species could also be a consequence of regular ways of transition mentioned above.

In the considered complex of genera it is easy to trace decrease in the body size of imagines and larvae (miniaturization), and also some correlation in pedomorphic transformations of imaginal structures with the profundity of anthophagization. These pedomorphic transformations are expressed in general simplification of structures, shortening of elytra, reduction of surface sculpture and pubescence. As an expression of adaptive tendency to larval desembryonization we can regard a progressive reduction of many body appendages and chaetotaxy as well as simplification in mouth parts. Mining larvae of *Anister* species have obsolete appendages on tergites and lacking urogomphi. Thus, in the considered complex of genera we can observe transformation of larval structures from the silphoid type of differentiation especially among true mycetophagous forms to the bruchoid type in the phytophagous *Anister*.

Other anthophagous Nitidulidae:

1. Subfamily Epuraeinae.

Complete anthophagy is recorded for some representatives of at least 3 genera of this subfamily (*Epuraea*, *Propetes* = *Amystrops* syn. n. = *Platychoropsis* syn. n. and *Grouvellia*), though this feature can be expected among many forms with unstudied bionomy having an appearance which gives reason for such an assumption. Imagines of many others visit flowers being obliged to or regularly.

2. Subfamily Carpophilinae.

Many adults visit flowers, and in some cases the pollination of the plants with participation of some species of this subfamily is recorded. The species of genus *Nitops* stat. n. and in particular Nearctic and (?) Neotropical *Urocarpolus* subgen. n., as well as Nearctic and Neotropical subgenera *Caplothorax* subgen. n. and *Plapennipolus* subgen. n. of genus *Carpophilus* are connected with flowers in both active stages of their living circle.

3. Subfamily Meligethinae

All adults and larvae of all species of this subfamily subendemic for the Old World with known biology live and feed in flowers of the angiosperm plants (mainly dicotylodons). This group is rather monogenous in the structural, ecological and bionomical aspects of all adaptive tendencies of anthophagization.

4. Subfamily Nitidulinae

This subfamily includes 5 groups where a trophic transition from primary mycetophagy to anthophagy and phyllophagy has occurred or is happening now. The recent representatives of the genus *Perilopsis* known from Chile, Australia and New Guinea

seem partly to preserve an ancient connection with the male cones of the gymnosperm *Araucaria* and *Agathis*, though the Chilean species (*P. flava* (Reitter, 1873), non Kirejtshuk, 1986b) lives in *Nothofagus* inflorescence. Structures of small bodies of the *Perilopsis* larva and imago are scarcely modified in comparison with those of other groups in the Nitidula-lineage represented by the forms sharing a complete mycetophagy.

Anthophagization in the *Aethina*-complex of genera has been considered above.

The third group of the Nitidulinae with an expressed anthophagization is the tribe Cychramini. Regarding almost a world-wide occurrence of the *Cychramus* species, an early origin of this genus can be admitted. The known larvae of these species breed in fungi, but imagines, at least in the Holarctic, Australian and Neotropical regions, are more or less regular visitors of flowers. Species of other genera of this tribe with known bionomy have a rather small body and are larval miners and imaginal feeders on flowers (mainly pollen) of the Brassicaceae (*Xenostrongylus, Oxystrongylus, Strongyllodes*). The mining larvae of *Xenostrongylus* have a considerable resemblance to the meligethine larvae, but their mandibles with strong teeth along inner edge and an obsolete molar look more similar to those in the Chrysomeloidea and Curculionoidea than to those in other Nitidulidae.

The Neotropical tribe Mystropini includes some genera (*Mystrops, Cychropiestus, Platychorodes*). All species of *Mystrops* with known bionomy live in palm inflorescences. Imaginal structures of the above mentioned genera are rather similar and give evidence for supposing at least imaginal anthophagy for these groups. Body size of most representatives of this tribe does not exceed 3.5 mm (only the imaginal body of *Cychropiestus corvinus* with mandibles reaches to 7.0 mm). Imaginal structures of head with appendages and abdominal apex have some resemblance to those in the Meligethinae, but the imaginal mandible is quite similar to that in some Chrysomeloidea, in particular among anthophilous forms. On the other hand, the larval legs of the *Mystrops* species as well as those in the Meligethinae, *Xenostrongylus* and predaceous Cybocephalinae have a characteristic adoral vesicle at the apex of the last segment of their legs. Emergence of this tribe, perhaps, took place comparatively not so long ago, i.e. after separation of South America from other continents of the Southern Hemisphere.

As a fifth group in the Nitidulinae, in which a process like anthophagization can be traced, there is the genus *Camptodes* from the tribe Strongylini, species of which develop in the decaying *Opuntia* flowers in Central and South America.

5. Subfamily Cillaeinae

Many species from this subfamily are known as visitors of flowering plants and some of them live and breed in flowers during the larval period of their living cycle. Interconnections between the Cillaeinae and gymnosperm plants have scarcely a very ancient character. As a rule, the anthophagous forms have been recorded in the groups some species of which are connected with fungi. The members of genera *Macrostola* and *Selis* seem to be more or less specialized to inhabit flowers. Adaptive tendencies of anthophagization are not expressed in appearence of these species because of the recent appearance of their anthophagy. Many groups of the Cillaeinae prefer dead and decaying flowers and this preference is an additional evidence of the recent development of this feeding. Little-studied Cillaeinae of Hawaii need a parti-

cular consideration in aspect of anthophagization and phyllophagization which for now can be supported by the data from labels of museum specimens.

In contrast to the regions with temperate and subpolar climate in tropical and subtropical ecosystems it is possible to trace some relict interconnections of Nitidulids with gymnosperm cones and flowers. Many anthophagous Nitidulid groups show a tendency to become more similar to other anthophagous groups in comparison with the appearance of their probable closer relatives. Disparity in degree of larval differentiation and similar simplification of imaginal structures give a comparative evidence to ascertain level and age of anthophagization. Among the considered anthophagous groups a more or less ancient complete anthophagy can be recognized for the species of *Perilopsis, Anister* and some Cychramini from the Nitidulinae, and also for all representatives of the Meligethinae. The beginning of the anthophagization of these groups should be supposed near the Rubicon of the Mesozoic and Kainozoic eras. Anthophagization in some Epuraeinae, other genera of the *Aethina*-complex, the rest Cychramini and Mystropini from the Nitidulinae, perhaps, had a later start, could be in the Palaeogene. And species of the rest anthophagous groups of the Nitidulidae began to acquire this type of trophics even later.

On the other hand, in some tropical regions a situation of unususal abundance of unspecialized anthophagous forms (mainly from the Epuraeinae) has been found, particularly expressed on islands of the Polynesian region with comparatively recent faunistic complexes. The last peculiarity gives reason to suppose that the anthophagization of some Nitidulid groups is continuing till now involving new forms with a mycetophilous mode of life.

Taxonomical comments

1. Taxonomical references given in the catalogues by A.H. Grouvelle (1913), are here omitted.

2. On the synonymy of *Propetes* Reitter, 1875, *Amystrops* Grouvelle, 1906 and *Platychoropsis* Grouvelle, 1912/1913: The recent study of most described and many unnamed species regarded in composition of the mentioned taxa makes evident that all of them belong to a group of probably close relatives connected, in known cases, with the *Pandanus* flowers. As to synonymy *Propetes* Reitter, 1873 and *Amystrops* Grouvelle, 1906 (type-species: *Amystrops modiglianii* Grouvelle, 1906, here designated), it was established due to study the type specimen of the first proposed by monotypy (i.e. *Epuraea nigripennis* Redtenbacher, 1867 — Lectotype, male, here designated and 3 paralectotypes — "Fidler, Ceyl, 860"; all specimens in Natural History Museum in Vienna) and thousands of representatives of the second taxon. After a more detailed consideration of a composition of true "*Propetes*" and "*Platychoropsis*" in as wide scope as possible I could not find any clear character to distinguish these groups. Perhaps, if an indistinct difference in convexity of body between "*Propetes*" and "*Platychoropsis*" can be admitted, it is still necessary to revise all members of this group in order to recognise this as a diagnostic feature (perhaps, some of them were described by L. R. Gillogly (1982) among *Haptoncus* Murray, 1864). Moreover, *Propetes seychelensis* sp. n. looks more like some species

from Australia and Polynesia than Indo-Malayan ones, while *P. aquilus* sp. n. has some features which put it apart from all other forms of the group. It can be supposed that the Epuraea group here united in *Propetes* is in a sense analogous with the Neotropical anthophagous *Mystrops* from the Nitidulinae connected with palm inflorescences. The Afro-Madagascarean Meligethinae also connected with inflorescences of palms (Endrödy-Younga 1978) can be considered as another anologous group. The genus *Propetes* consists of a great number of species while other seemingly anthophagous genera and subgenera of the Epuraeinae are monotypic or represented by a few species (*Apria* Grouvelle, 1919; *Parepuraea* Jelinek, 1977; *Grouvellia* Kirejtshuk, 1984; *Baloghmena* Kirejtshuk, 1987; *Polinexa* Kirejtshuk, 1989b; *Ceratomedia* Kirejtshuk, 1990a; *Mystronoma* Kirejtshuk, 1990a, etc.). Though among the largest groups of the subfamily with a mainly mycetophilous mode of life (*Epuraea* Erichson, 1843; *Haptoncus* Murray, 1864; *Micrurula* Reitter, 1884) some representatives became anthophagous as well. In order to show a scope of structural variability of the considered group 4 aberrant forms are here described, but for two of them a new subgeneric taxon is proposed. The phylogenetic relations of the *Propetes* proposed for *Platychropsis* (Kirejtshuk 1986b) remain acceptable for this united group and according to the opinion formerly published the links of this group with some groups of *Haptoncus* Murray, 1864 can be expected; *Tetrisus* Murray, 1864 = *Trimenus* Murray, 1864, *Tritesus* Heller, 1916 and *Baloghmena* Kirejtshuk, 1987.

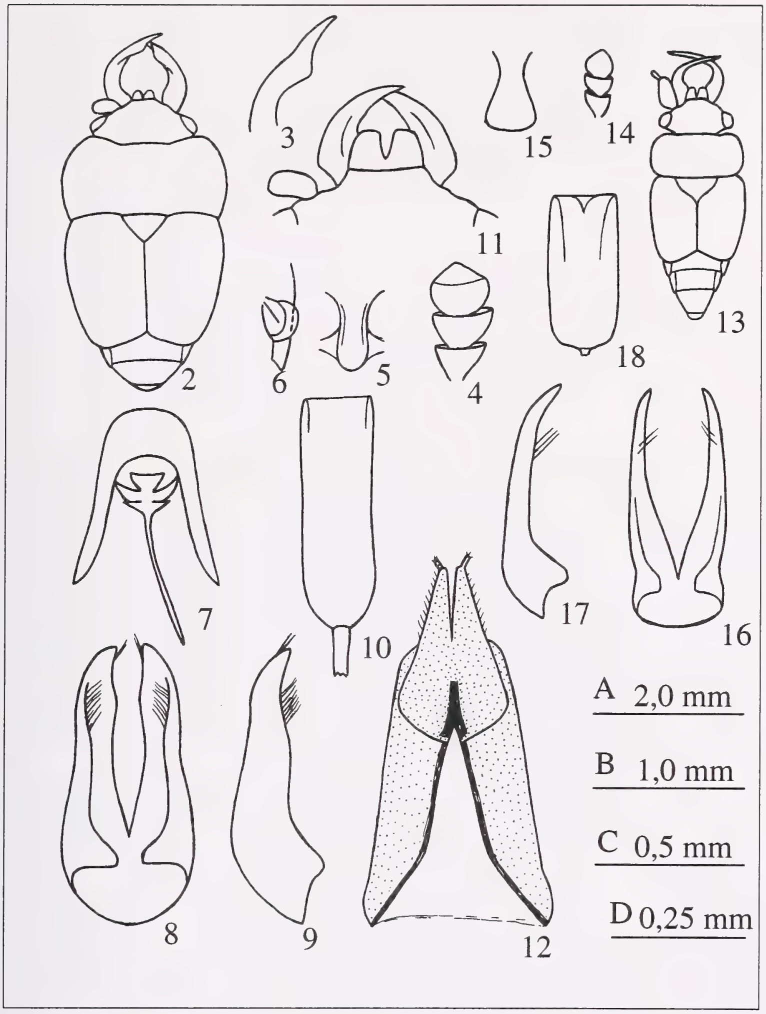
The following synonymy can be summarized: *Propetes* Reitter, 1875 (= *Amystrops* Grouvelle, 1906, syn. n.; *Platychorinus* Grouvelle, 1906; *Platychoropsis* Grouvelle, 1912/1913, syn. n.; *Haptoncognathus* Gillogly, 1962 - see Grouvelle 1913 and Kirejtshuk 1986b).

3. *Propetes* (*Propetes*) *aquilus* Kirejtshuk, sp. n. — figs 2—12.

Specimens examined — Holotype, male and 53 Paratypes — "E slope Mt. McKinley, Danao Province, MINDANAO, 15: VIII; 46", "CNHM. Philippine Zool. Exped. (1946—47), H. Hoogstraal & D. Heynemann leg.", "El. 3200—4200", "in leaf axils on climbing *Pandanus*" (holotype and most paratypes are deposited in the Field Museum of Natural History in Chicago, some paratypes in the Zoological Institute of the Russian Academy of Sciences and the Zoological Research Institute and Museum Alexander Koenig in Bonn).

Male, holotype. Length with mandibles 5.0 (and without 4.3), breadth 2.1, height 1.0 mm. Rather convex dorsally and slightly — ventrally; dorsum dark reddish brown with nearly black mandibles; ventral surface and appendages (except mandibles) reddish, though metepisterna, epipleura and ventrites somewhat darker; dorsum almost dull, but ventral surface almost with a moderate shine; body covered with fine, subrecumbent, moderately conspicuous, greyish golden hairs, length of which about 2.5 times more than the distance between their roots on dorsum; anal sclerite with a brush of long hairs at apex.

Head, pronotal and scutellar surface with punctures 1.5—2.0 times as large as eye facets, smaller on head and becoming larger to pronotal base, interspaces between them about a puncture diameter and narrower at pronotal base, nearly alutaceous. Elytral surface somewhat as that on head and pronotum, but with punctures at base larger and denser. Surface of pygidium, preceding tergite and



Figs 2—18: *Propetes* (*Propetes*) spp. — *P.* (*P.*) *aquilus* sp. n. (2—12): male (holotype: 2 — body from above; 3 — apex of left mandible, fronto-dorsal; 4 — antennal club; 5 — medial part of prosternum with process, ventral; 6 — idem, lateral; 7 — anal sclerite, ventral plate and spicula gastrale, ventral; 8 — tegmen, ventral; 9 — idem, lateral; 10 — penis, dorsal; female: 11 — fore part of head with mandibles, dorsal; 12 — ovipositor, ventral; *P.* (*P.*) *seychellensis* sp. n. (13—18): male (paratype): 13 — body from above; 14 — antennal club; 15 — prosternal process, ventral; 16 — tegmen, ventral; 17 — idem, lateral; 18 — penis, dorsal. Scales: A — to figs 2, 13; B — to figs 5, 6; C — to figs 4, 7, 11, 14, 15; D — to figs 8—10, 12, 16—18.

ventrites with small punctures about as large as eye facets, interspaces between them less or up to a puncture diameter, finely and distinctly microreticulated. Surface of metasternum with sparse punctures, somewhat larger than eye facets, interspaces 2—3 puncture diameters, smoothedly microreticulated. Prosternal surface with very

small and sparse punctures, with very fine and dense undulate microreticulation. Head more than twice shorter than the distance between eyes which consist of rather small facets, with elevated antennal insertions and a wide depression between them. Mandibles with a blunt process before acute apices. Labrum with a deep and wide excision between lobes. Antennae with long and dense hairs, much longer than head broad overreaching pronotal base, their club composing a fourth of total antennal length. Pronotum with a narrow border along perimeter (obsolete in the middle of fore edge), slightly excavated fore and hind edges, and sides gently sloping to extremely narrowly explanate lateral edges. Elytra with arched lateral and oblique apical edges, their sides steeply sloping to extremely narrowly explanate lateral edges. Elytral apices leave pygidium and preceding tergite uncovered. Pygidium with a truncate apex, under which a widely rounded apex of anal sclerite exposed. Terminal segment of maxillar and labial palpi rather long, although of usual structure. Antennal grooves scarcely expressed at arched sides of mentum. Prosternum flattened, its process scarcely medially curved and with a vertically abrupt and rather narrow apex. The distance between mid coxae subequal and that between hind ones about twice more than that between fore coxae. Mesosternum deeply excavated and with a well raised but not sharp medial ridge. Metasternum flattened, with medial suture well expressed nearly along the entire length, angularly excised hind edge between coxae, a well raised intercoxal line between mid coxae and caudal marginal lines behind mid coxae closely following hind edge of coxal cavities. 1st ventrite longest and without a trace of caudal marginal lines behind coxae. Hypopygidium with a nearly truncate or slightly bisinuate apex. Epipleura at base a little narrower than antennal club. Legs moderately raised. Tibiae comparatively short and subequal, nearly as long as prosternum and its process combined, somewhat narrower than antennal club, but a little wider than prosternal process: fore one finely crenulate along outer edge and with a strong subapical tooth curved ventrally; mid and hind ones with long hairs, particularly conspicuous in two rows along their outer edge, and a few subapical stout thorns. Femora with usual outlines of gently convex fore and hind edges: fore and mid ones about 1 and 2/3, but hind ones more than twice as wide as corresponding tibiae. Fore tarsi as wide as fore tibiae, mid and hind ones much narrower, claws moderately long and toothed at base. Tegmen well and penis trunk moderately sclerotized.

Female. Externally differs from the male by more or less smaller prothorax and head, flattened surface of head, normally developed mandibles, shorter antennae with moderately raised scapus, less raised medial ridge on mesosternum, moderately rounded pygidial and widely rounded hypopygidial apices. Ovipositor with usual sclerotization.

Variations. Minimal length with mandibles 2.7, but maximal one as that of the holotype (with mandibles 5.0 and without 4.3), breadth 1.4—2.5, height 0.8—1.0 mm. Sexual dimorphism is scarcely exhibited in the smallest males which differ from the females mainly by a little longer antennae as well as apices of pygidium and hypopygidium. The same holds true for the medial ridge on mesosternum which is well developed in larger males and rather weakened in smaller ones. A certain variability is expressed in coloration, punctuation, sculpture and pubescence.

Notes. *P.* (*P.*) *aquilus* sp. n. differs from all other members of the genus by comparatively large and robust body, particularly by its unicoloured dark dorsum, a well raised medial ridge of male mesosternum and also by a combination of features in punctuation, sculpture and pubescence of body sclerites. Besides that, this new species shows a resemblance with species of *Mandipetes* subgen. n. in having of a narrow prosternal process as well as expressed intercoxal line between mid coxae and caudal marginal lines behind mid coxae. Finally, its toothed tarsal claws are also enough diagnostic for this new species among the consubgeners. According to the labels pinned under the studied specimens they have been collected as well as those of *P.* (*Mandipetes*) *longipes* subgen. et sp. n. "in leaf axils", though attendance of these species in inflorescences of *Pandanus* for feeding and larval development is more probable in comparison with a possibility of their links with leaves or fungi seemingly growing in wet sites on vegetative organs of Pandanus.

4. *Propetes* (*Propetes*) *seychellensis* Kirejtshuk, sp. n. — figs 13—18.

Specimens examined — Holotype, male and 1 paratype, male "Seych., Mahe', Mare aux cochous, 15. 12. 1992, Malicky" (holotype is deposited in Natural History Museum in Vienna and paratype — Zoological Institute of Russian Academy of Sciences).

Male, holotype. Length with mandibles 4.0 (and without 3.5), breadth 1.4, height 0.6 mm. Weakly convex dorsally and ventrally; straw coloured with black eyes; body with a faint shine, partly almost dull; thoracic segments and elytra with very fine, subrecumbent, scarcely conspicuous hairs, length of which about the distance between their roots on elytra, but tergites uncovered by elytra and ventrites with denser and more conspicuous yellowish pubescence; anal sclerite with 4, hind edge of hypopygidium with some and other sclerites of abdomen with a few rather long and thick reddish setae.

Head surface with distinct punctures a little larger than eye facets, interspaces between them a little more or less than a puncture diameter, nearly alutaceous, especially at base. Surface of pronotum, elytra and metasternum somewhat as that on head, but with punctures somewhat larger, interspaces between them 2—3 puncture diameters, with dense, cellular and partly smoothed microreticulation. Surface of pygidium, preceding tergites and ventrites with punctures about twice smaller than eye facets, interspaces between them approximately as those on head surface, finely and densely microreticulated. Prosternal surface with very small, scarcely visible and sparse punctures, with very fine and dense undulate microreticulation. Head more than twice as short as the distance between eyes consisting of comparatively large facets, with rather elevated antennal insertions and a wide and shallow depression between them. Besides it, a medial "endocarina" is traced in basal half. Mandibles rather narrow and long with simple acute apices strongly curved almost turning backwards. Labrum with a deep and wide excision between lobes. Antennae with rather long hairs, reach scutellar apex, their scapus much bigger than their club (nearly as long as the distance between antennal insertions), their club composing about a fifth of total antennal length. Pronotum widest at fore half and almost bisinuate at base, with a narrow border along perimeter, almost convex fore

and hind edges, disk flattened and sides comparatively steeply sloping to unexplanate lateral edges. Elytra with arcuate lateral and oblique apical edges, their sides steeply sloping and a little curving ventrally at unexplanate lateral edges. Elytral apices leave pygidium and 2 preceding tergites uncovered. Pygidium with a truncate apex, under which a widely rounded apex of anal sclerite is exposed. Terminal segment of maxillar and labial palpi rather long, but of usual structure. Antennal grooves completely untraced at arched sides of mentum which slightly more than twice as wide as long. Prosternum flattened, its process medially somewhat curved and widened before flat and widely rounded apex. The distance between mid coxae twice than that between fore ones and a little less than that between hind coxae. Mesosternum shallowly excavated and without any carina along the middle. Metasternum flattened, with medial suture well expressed nearly along the entire length, shallowly archedly emarginate hind edge between coxae, without a trace of intercoxal line between mid coxae and caudal marginal lines behind mid coxae. 1st ventrite longest and without a trace of caudal marginal lines behind coxae. Hypopygidium with a widely rounded hind edge. Legs moderately raised. Tibiae comparatively short and subequal, nearly as long as prosternum with process, much wider than antennal club, but a little narrower than prosternal process: fore one finely crenulate along outer edge and with 2 strong subapical teeth; mid and hind ones with long hairs, particularly conspicuous in two rows along their outer edge and 1—2 strong subapical spines. Femora with usual outlines of gently convex fore and hind edges, fore and mid ones about 1 and 2/3, but hind ones more than twice as wide as corresponding tibiae. Fore tarsi about 2/3 width of fore tibiae, mid and hind ones significantly narrower, claws moderately long and simple. Tegmen well and penis trunk moderately sclerotized.

Variation. Length with mandibles 3.1 (and without 2.7), breadth 1.2 mm. The second studied specimen (paratype) has smaller head less convex at base, somewhat narrower pronotum, less raised mandibles and antennae.

Notes. *P. seychellensis* sp. n. has some more resemblance to the species described by L. R. Gillogly (1962) in the *Haptoncognathus* as well as to *P. puberulus* (Kirejtshuk 1986b), comb. n. and *P. subcalvus* (Kirejtshuk 1986b), comb. n. (both described as *Platychoropsis*). This new species is characterized by a rather short head without bulbed temples, but with extremely curved mandibles and rather enlarged antennal scapi, a wide and comparatively short pronotum with straight, almost convex fore edge and gently rounded hind corners and also rather sparse dorsal punctuation. This combination of characters allows to determine it from the species given in the key elaborated by A.G.Kirejtshuk (1986b). Moreover, a traced medial "endocarina" is unknown among other representatitives of the family at all.

5. *Mandipetes* Kirejtshuk, subgen. n. Type species: *Propetes* (*Mandipetes*) *longipes* subgen. et sp. n. Includes also *P.* (*M.*) *intritus* subgen. et sp. n. As yet recorded from Vietnam and Philippine islands.

Notes. This group is quite distinct from *Propetes* s. str. mainly by the characters of the structure of mouth parts and some others mentioned below. As both species here included in *Mandipetes* subgen. n. share a more or less stable combination of derived features, a separate taxon seems advisable.

Propetes s. str.: (1) mandibles, if long, with a simple apex or, if short, with a small subapical tooth, although in a few cases (*P.* (*P.*) *pacificus* Gillogly, 1962, comb. n.) with apices represented by two long teeth; (2) mentum with usual shape and proportion, composed of a small or medium part of ventral surface of epicranium; (3) maxillar lobe and palpus comparatively long, but of usual structure; (4) sides of pronotum unnarrowed to its base forming acute apices of hind corners, or gently narrowed with widely rounded apices, and infrequently with a configuration as that in *Mandipetes* subgen. n., fore edge of pronotum usually with complete or rarely with obsolete carina; (5) legs of medium sizes, tibiae moderately widened apically;

Mandipetes subgen. n.: (1) mandibular apex with two long teeth; (2) mentum rather enlarged and subquadrangular, composed of more than half of ventral surface of epicranium; (3) maxillar lobe very narrow and long with setae posteriorly oriented along its inner edge, and palpus very long, with ultimate and penultimate segments dilated at apices and with setae posteriorly oriented along its inner edge; (4) sides of pronotum narrowed as anteriorly as posteriorly and its hind corners with angular blunt apices, fore edge of pronotum with obsolete carina; (5) legs comparatively long and very narrow.

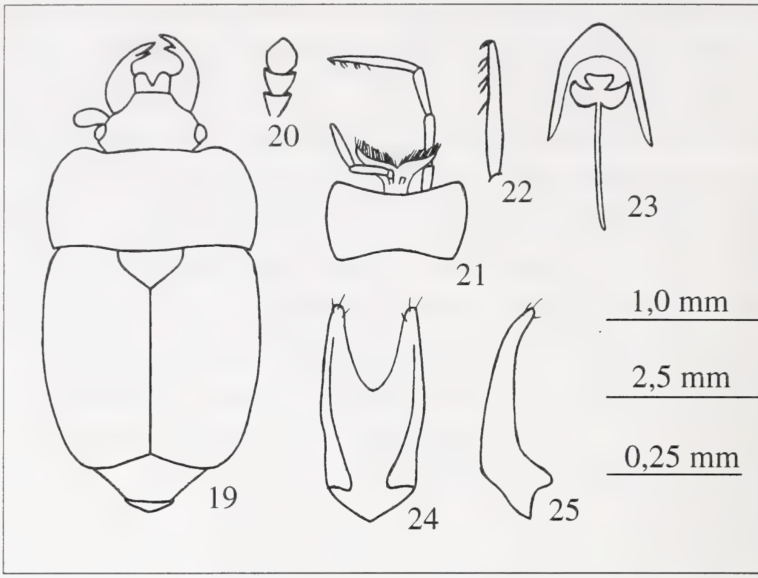
Remarks on bionomy. General shape and peculiarities of mouth parts, antennae and legs, including wide lobes of 1—3 tarsomeres give an evidence on anthophagous mode of life for at least imagines of *P. longipes* sp. n. It should be supposed that both species of *Mandipetes* subgen. n. are associated with *Pandanus* inflorescences as other species of the genus (subgenus *Propetes* s.str.).

6. *Propetes* (*Mandipetes*) *intritus* Kirejtshuk, subgen. et sp. n. — figs 19—25.

Specimens examined — Holotype, male — “Vietnam, Tam Dao, Son Zuong, hills in valley, 21. II. 1962, O.Kabakov” (in Cyrillic letters) (holotype is deposited in Zoological Institute of Russian Academy of Sciences).

Male, holotype. Length with mandibles 2.8 (and without 2.5), breadth 1.5, height 0.7 mm. Moderately convex dorsally and ventrally; bright reddish with somewhat darkened pronotum, thoracic sterna and 1—3 ventrites, and with chestnut brown elytra; body with a particularly bright shine; dorsum with extremely fine, scarcely visible, very short hairs; vertral surface with slightly conspicuous yellowish hairs, length of which somewhat less than the distance between their roots on ventrites.

Head, pronotal, scutellar and elytral surface with distinct punctures about 1.5 times as large as eye facets, interspaces between them 2.0—3.5 puncture diameters (a little narrower on elytra), completely smooth. Pygidial surface with not quite distinct punctures a little larger than eye facets, interspaces between them somewhat more than a puncture diameter, densely and conspicuously microreticulated. Surface of metasternum and 1st ventrite with sparse distinct punctures, somewhat smaller than on dorsum, interspaces 1.5—2.5 puncture diameters, smooth, but surface of 2—5 ventrites with smaller and denser punctures and with a trace of microreticulation more expressed posteriorly. Prosternal surface with rather small punctures smaller than eye facets, interspaces between them with very fine and smoothed microreticulation. Head about 1.5 times shorter than the distance between eyes which consist of medium facets, weakly convex and with a shallow depression between slightly elevated antennal insertions. Mandibles with a sharp process before acute apices.



Figs 19—25: *Propetes* (*Mandipetes*) *intritus* sp. n., male, holotype: 19 — body from above; 20 — antennal club; 21 — mentum with maxillar and labial palpi, ventral; 22 — last segment of maxillar palpi; 23 — anal sclerite, ventral; 24 — tegmen, ventral; 25 — idem, lateral. Scales: A — to fig. 19; B — to figs 20, 21, 23; C — 24, 25.

Labrum with a deep and wide excision between lobes. Antennae no longer than head broad, their club very narrow and composing about $^2/_7$ total antennal length. Pronotum with a narrow border along its perimeter (obsolete in the middle of fore edge), excavated fore and slightly emarginate hind edges, and sides gently sloping to unexplanate lateral edges. Elytra with arcuate lateral and oblique apical edges, their sides steeply sloping to bordered but not explanate lateral edges. Elytral apices leave pygidium entirely uncovered. Pygidium with a truncate apex, from which a subangular apex of anal sclerite exposed. Terminal segment of maxillar palpi very long with curved apex and a row of setae along its inner side. Terminal segment of labial palpi rather long and thin, though of usual structure. Antennal grooves scarcely expressed at sides of subquadrangular mentum which twice as wide as long and with emarginate fore edge. Prosternum flattened, its process scarcely medially curved and subparallel at sides, with vertically abrupt apex a little narrower than antennal club. The distance between mid coxae 1.5 times and that between hind ones 3.0 times more than that between fore coxae. Mesosternum deeply excavated and with a weak medial carina. Metasternum slightly convex, with a medial suture well expressed along the distal $^2/_3$, archedly emarginate hind edge between coxae, a well raised intercoxal line between mid coxae and caudal marginal lines behind mid coxae closely following hind edge of coxal cavities. 1st ventrite longest and without a trace of caudal marginal lines behind coxae. Hypopygidium a little shorter than 1st ventrite with a nearly truncate or slightly bisinuate apex. Legs with a moderate length, but comparatively

narrow. Tibiae short and subequal, somewhat longer than prosternum and its process combined, nearly as wide as prosternal process: fore one finely crenulate along outer edge and with a medium subapical tooth; mid and hind ones with moderately long hairs, partly disposed in two rows along their outer edge. Femora with usual outlines of gently convex fore and hind edges: fore and mid ones about 1 and $^2/_3$; but hind ones more than twice as wide as corresponding tibiae. Fore tarsi $^2/_3$ as wide as fore tibiae, mid and hind ones much narrower, claws moderately long and toothed at base. Tegmen moderately and penis trunk weakly sclerotized.

Notes. This new species differs from another known member of the subgenus, except aedeagal structures, by smaller body, wide base of male mandibles with a setae row along their basal part only, narrower and compact antennal club composing $^2/_7$ total antennal length, the distance between mid coxae subequal with width of antennal club, tibiae about as long as prosternum and its process combined, toothed claws. On the other hand, *P.* (*M.*) *intritus* subgen. et sp. n. has an appearance somewhat similar to *P.* (*P.*) *nigripennis* (Redtenbacher, 1867) and some other Indo-Malayan species from *Propetes* s.str., however, the body of this new species has a particularly bright shine and strongly reduced pubescence, distinctive pronotum archedly narrowed anteriorly as well as posteriorly, comparatively narrow antennal club, structure of male maxillar palpi, longer and narrower labial palpi, large mentum, narrower legs and toothed tarsal claws. The characters of this new species partly correspond with the description of *Propetes bicolor* (Grouvelle, 1910), comb. n. (a species still unknown to me), but is formally distinguishable from the latter by its shiny body with reduced pubescence and the shape of the pronotum (pronotum of *P. bicolor* comb. n. with emarginate fore edge, "angulis rotundatis" fore and backwards with projected hind corners).

7. *Propetes* (*Mandipetes*) *longipes* Kiretshuk, subgen. et sp. n. — figs 26—37.

Specimens examined — Holotype, male and 1 paratype: "E. slope Mt. McKinley, Davao Prov., MINDANAO, 24 Sept.: 46", "Elev.: 3300 ft", "CNHM Philippine Zool. Exped. (1946—47), H. Hoogstraal & D. Heynemann leg."; 6 paratypes: ibid. "... IX:1:46", "in leaf axils of climbing Pandanus", "elev. 3000 ft.", "CNHM Philippine Zool. Exped. (1946—47), H. Hoogstraal & D. Heynemann leg." (holotype and 4 paratypes are deposited in the Field Museum of Natural History in Chicago and the remaining paratypes in the Zoological Institute of Russian Academy of Sciences.

Male, holotype. Length with mandibles 5.5 (and without 4.6), breadth 2.2, height 1.0 mm. Moderately convex dorsally and ventrally; bright reddish with black elytra; rather shiny; dorsum with sparse, long, subrecumbent and quite conspicuous yellowish hairs, length of which is nearly 5 times more than the distance between punctures; ventral surface with very short and slightly conspicuous pubescence.

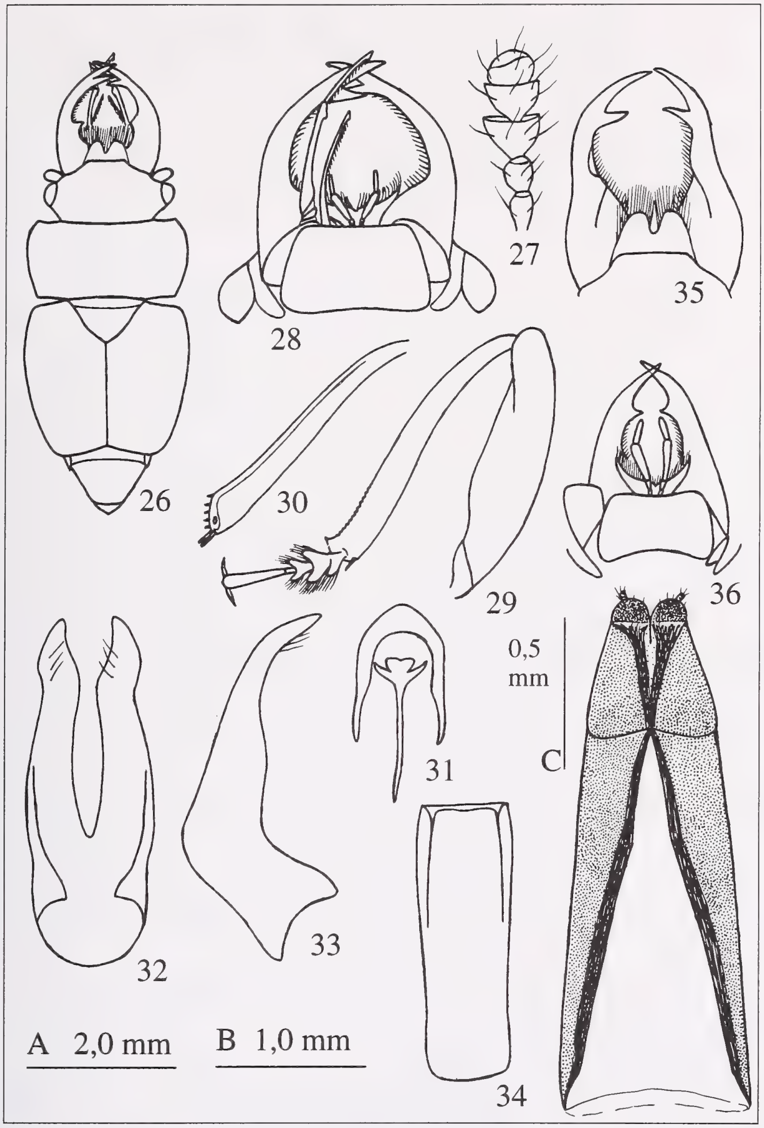
Head and pronotal surface with punctures as large as eye facets, interspaces between them 2—4 puncture diameters (and less at pronotal sides and base), smooth. Elytral surface with somewhat larger and denser punctures than those on head and pronotum, interspaces between them with a trace of alutation. Surface of tergites uncovered by elytra and prosternum with very small, not quite distinct and moderately dense punctures and cellularly microreticulated interspaces between them. Surface of ventrites and metasternum with less distinct punctures than on head,

pronotum and elytra which are somewhat smaller than eye facets, interspaces between them 1—2 puncture diameters on ventrites and 3—4 puncture diameters on metasternum, nearly as reticulated as that on pygidium and prosternum. Head 1.5 times shorter than the distance between eyes, composed of moderately small facets, and strongly concave between antennal insertions. Antennae a little longer than head broad, with 3-segmented club. Mandibles with 2 processes along inner edge and densely haired along inner ridge of their ventral surface. Labrum with deeply and widely separate lobes. Maxillar palpi with very long penultimate and ultimate segments widened at apex and densely haired along inner edge. Mentum very large and rather projected anteriorly. Pronotum with slightly and evenly convex surface and obsolete fore edge at neck. Elytra steeply sloping to narrowly bordered lateral edges and transverse apices, remaining pygidium and a part of preceding tergite uncovered. Exposed tergites and anal sclerite well sclerotized and rather convex. Antennal grooves on ventral side of epicranium unexpressed. Prosternum slightly convex with a narrow process slightly medially curved and vertically abrupt at apex. The distance between mid coxae about twice less, but that between hind ones twice more than the distance between fore coxae. Mesosternum deeply excavated and slightly convex at bottom. Metasternum flattened, with a well raised medial suture and a subangular emargination of hind edge between coxae. Hypopygidium almost 1.5 times longer than 1st ventrite and nearly with a transverse apex. Legs narrow, long and rather simplified. Tibiae somewhat narrower than antennal club: fore one finely crenulate, mid and hind — with 2 longitudinal rows of dense, thin and short hairs along their outer edge. Femora with usual outlines of gently convex fore and hind edges, more than twice as wide as tibiae. Fore tarsi somewhat wider, but mid and hind ones somewhat narrower than the corresponding tibiae, with moderately raised claws slightly toothed at base. Aedeagus well sclerotized.

Female. Externally differs from male by less wide fore edge of pronotum and head, different antennal club, suberected mandibles with less projected inner processes, much shorter penultimate and ultimate segments of maxillar and labial palpi, mentum less projected anteriorly, prosternal process more curved medially and with sloping edges, a little shorter legs, widely rounded or nearly subangulate pygidial apex and gently rounded hypopygidial apex. Ovipositor well sclerotized.

Variation. Length with mandibles 4.4—5.5 (and without 4.0—4.6) mm. Pronotal disk of some paratypes more or less darkened. The second studied male (paratype) has in contrast with the holotype more arched pronotal sides, somewhat smaller head, different configuration of mandibles and prosternal process nearly as in females. Some variations are expressed in punctuation and sculpture of surface.

Notes. *P.* (*M.*) *longipes* sp. n. differs from another consubgener here described, except aedeagal structures, by larger body, much longer mandibles (particularly in males) with a narrower base and a row of setae along entire inner edge to base of a long subapical tooth, antennal club with loose articles, composing a fourth of total antennal length, distance between mid coxae considerably less than width of antennal club, tibiae much longer than prosternum and its process combined, comparatively long hypopygidium, almost simple tarsal claws. This new species is easily distinguishable from all the *Propetes* species by larger head with very wide fore edge and highly specialized characteristic mouth parts, shape of pronotum, convex



Figs 26—37: *Propetes* (*Mandipetes*) *longipes* subgen. et sp. n. Male, holotype: 26 — body from above; 27 — antennal club; 28 — ventral surface of head; 29 — fore leg, dorsal; 30 — mid tibia, dorsal; 31 — anal sclerite, ventral plate and spicula gastrale, ventral; 32 — tegmen, ventral; 33 — idem, lateral; 34 — penis trunk, dorsal; male, paratype: 35 — fore part of head with mandibles, dorsal; female: 36 — ventral surface of head; 37 — ovipositor, ventral. Scales: A — to figs 26; B — to figs 27—31, 35, 36; C — to figs 32—34, 37.

and long male anal sclerite, narrow and vertically abrupt prosternal process, long and narrow legs, comparatively long hypopygidium, genitalia of both sexes.

8. *Caplothorax* Kirejtshuk, subgen. n. Type species: *Carpophilus melanopterus* Erichson, 1843. Includes type-species, *Carpophilus rufus* Murray, 1864, and some still undescribed species from the Neotropical region. Nearctic and Neotropical distribution.

Notes. The species of this subgenus are characterized by appearance partly similar to the species of *Urocarpolus* subgen. n. (perhaps, as a result of convergent evolution of anthophilous mode of life in both groups), but with male anal sclerite and genitalia of both sexes as those in other groups of the genus *Carpophilus*, but not as in the species of *Nitops* stat. n. Acute pronotal corners of the *Caplothorax* subgen. n. are very distinctive from those in other anthophagous forms from the two genera *Carpophilus* and *Nitops* stat. n. The new subgenus seems to have some relationship to subgenus *Megacarpolus* Reitter, 1919 in which some species from the New World should be included, but differs from it by more convex and oval body, peculiarities of sexual dimorphism and aedeagal structures as well as mode of life of its members. On the other hand, species of the *Caplothorax* subgen. n. seem to be related to those of *Plapennipolus* subgen. n., but much more convex and dull because of strongly contrasting microreticulation, and with compact and wide antennal club. Finally, the species of the *Caplothorax* subgen. n. has also some resemblance to the Papuan *Carpophilus* (*Loriarulus*) *poggii* Kirejtshuk, 1987 with unknown bionomy (including acute pronotal corners), but differs from the latter by much shorter last abdominal segment with a simple apex in female and convex dorsum. Perhaps, three subgenera (*Loriarulus* Kirejtshuk, 1987, *Caplothorax* subgen. n., *Plapennipolus* subgen. n.) have their phyletic roots among an ancestor group very close to the *Megacarpolus* species of which for now maintain a more plesiotypic appearance and mycetophilous mode of life. The Nearctic *Carpophilus longus* Fall, 1910 seemingly connected with flowers of *Yucca* has an unclear position between *Caplothorax* subgen. n. and *Plapennipolus* subgen. n., though very different from both by rather slender body and *Myothorax*-like pronotum with long-fringed sides.

9. *Plapennipolus* Kirejtshuk, subgen. n. Type species: *Colastus yuccae* Crotch, 1874. Includes also ? *Carpophilus rufiventris* Schaeffer, 1911. Endemic Nearctic distribution.

Notes. This new subgenus is characterized a particularly flattened dorsally and ventrally body with rather wide elytra and abdomen (external appearance to some of *Colopterus* species from the Cillaeinae) and more loose and elongate antennal club in contrast with the member of *Caplothorax* subgen. n. and *Megacarpolus* (seemingly related to this subgenus). Its position has been regarded above in the consideration of *Caplothorax* subgen. n. and will be discussed more detailed in one of the further papers.

10. Genus *Nitops* Murray, 1864, stat. n. Type-species: *Carpophilus* (*Nitops*) *ophthalmicus* Murray, 1864. Composition (besides type-species) is referred to in Grouvelle (1913) and Dobson (1972); a group of species included here in *Urocarpolus* subgen. n. should also be inclued in genus *Nitops*. The taxa *Nitops* and *Endomerus* proposed by Murray (1864) were regarded as synonyms by some authors (Sharp 1887—1905; Grouvelle 1913; Junk's catalogue and others). In this paper the tradition is tentatively continued until a more detailed revision of this group is available.

Notes. This genus in contrast with all other groups of the Carpophilinae is characterized by unexcised hypopygidial and abruptly transverse pygidial apices in males, forming together a round foramen for the apically projected anal sclerite. Only one species of the Carpophilinae known from Himalalya and Indochina (*Urophorus* (*Anophorus*) *prodicus* Hinton, 1944) has a similar abdominal structure, i.e. male hypopygidium of this species without the depression characteristic for *Anophorus* Kirejtshuk, 1990b, but distinctly and widely emarginate at apex. As structure of genital capsule and aedeagus in both mentioned cases is a derived character, a secondary (? reversal) and independent development of the last abdominal segment can be admitted for both species of *Nitops* stat. et sensu n. and *U.* (*A.*) *prodicus*. The groups of species here regarded as subgenera of *Nitops* stat. et sensu n. are characterized also by a compact 3-segmented antennal club with the largest ultimate segment (most of the members of *Carpophilus* have 9th segment partly loose from consolidated 10th and 11th ones). Besides that, the species of *Nitops* stat. et sensu n. differ from all groups of the subfamily, having strongly convergent antennal grooves and very large eyes composed of comparatively large facets, as well as a highly specialized structure of ovipositor. The species of both subgenera of the considered genus according to the labels attached to museum specimens are usual visitors of flowers of the angiosperms and Connell (1956) had recorded the development of larvae *N.* (*U.*) *floralis* comb. n. in flowers of *Opuntia opuntia*.

11. *Urocarpolus* Kirejtshuk, subgen. n. Type species: *Cercus pallipennis* Say, 1823. Other species in this subgenus: *Carpophilus floralis* Erichson, 1843; *Carpophilus mexicanus* Reitter, 1873 (? = *nigrovittatus* Parsons, 1943); *Carpophilus longiventris* Sharp, 1889; ? *Carpophilus obtusicollis* Reitter, 1873. Distributed in the Nearctic region and Mexico.

Notes. The subgenera of *Nitops* stat. et sensu n. can be diagnosed after the following features:

Nitops s. str.: (1) eyes very large and consisting of large facets, temples not raised; (2) antennal grooves strongly nearly rectilinearly convergent; (3) length of elytra subequal or usually more than their combined width; (4) female with a pygidial apex with rounded or subtruncated hind edge and a beetled process in the middle; (5) ovipositor wide with unnarrowed and unforked gonocoxites subtruncate at apex.

Urocarpolus subgen. n.: (1) eyes moderately large and consisting of moderately small facets, temples exposed behind them; (2) antennal grooves strongly curved and feebly convergent; (3) length of elytra considerably shorter than their combined width; (4) female pygidial apex subacute; (5) ovipositor with slightly modified sclerites of gonocoxites narrowed to the forked apex.

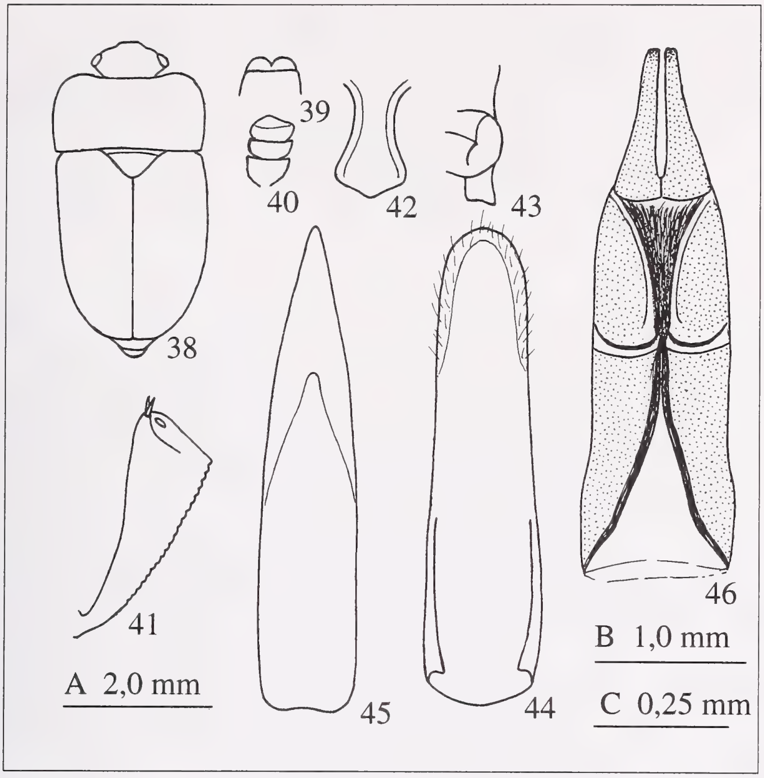
12. *Brounthina aequalis* Kirejtshuk, gen. et sp. n. — figs 38—46.

Specimens examined — Holotype, male: "sp.", "Mt. Owen, 26-2-14", "New Zealand, Broun Coll. 1922—482"; paratypes: 2 — "Glen Hope, 20-2-15", "New Zealand, Broun Coll. 1922—482"; 1 — "Pacuratani, 2-1-1915", "New Zealand, Broun Coll. 1922—482"; 2 — "New Zealand, Gollanz Valley, 1-II. 1924, in fungus, G. V. Hudson"; 1 — "New Zealand, Wallington, — II. 1924, in fungus, G. V. Hudson"; 2 — "NZ. Nelson Lakes N P., 2000', 28—30. V. 1976, O.Kukal"; 1 — "N. ZEAL., BR, Punakaiki, Porarari R., 29. XII—3. I. 1984, 35 m, L. Masner, Nothof., prim.

for."; 2 — "N. Zeal.; S. Isl., 30 km W Collingwood, Mangarakau, 50 m, 20. V. 82, S. & J. Peck, mixedforest litter"; 1 — ibid... "13 km NW Takara Washburn Res., 10 m, 19. V. 82, S. & J. Peck, beech log litter"; 2 — ibid... "BR. Nelson Lks. N. P., LK Rotoiti, St. Arnaud Track, 670 m, (14-XII-1984)—(6-I-1985)", "*Nothofagus* spp. for., log & leaf litter, A. Newton & M. Thayer"; 2 — ibid... "Mt. Robert Road, 660 m, (26-XII-1984)—(6-I-1985)", "*Leptospermum-Nothof.* scrub log & leaf litter, A. Newton & M. Thayer"; 1 — ibid... "N Slope Mt. Robert, Speargrass Tr., 880 m, (21-XII-1984)—(6-I-1985)", "*Nothofagus* spp. for., tree crotch litter, A. Newton & M. Thayer"; 1 — ibid... "SD, Tennyson Inlet, E Side Duncan Bay, 30 m, (15-XII-1984)—(5-I-1985)", "*Nothofagus* for. litter u. palm leaf litter, A. Newton & M. Thayer"; 1 — ibid... "SD, Tennyson In-let, W Side Te Mako Bay, 125 m, (15-XII-1984)—(5-I-1985)", "*Nothofagus*-podo-pdwd. log & leaf litter, A. Newton & M. Thayer"; 1 — ibid... "NN, Takara R., Cobb Dam., Asbestos For. Walk, 410 m, 2-I-1985", "*Nothofagus*-podo-pdwd. log & leaf litter, A. Newton & M. Thayer" (holotype and 4 paratypes are deposited in the Natural History Museum in London; other paratypes in Zoological Institute of Russian Academy of Sciences, Field Museum of Natural History in Chicago, Biosystematic Research Institute in Ottawa, Canadian Museum of Nature in Ottawa and Zoological Research Institute and Museum Alexander Koenig in Bonn).

Male, holotype. Length 4.3, breadth 2.1, height 1.0 mm. Moderately convex dorsally and slightly — ventrally; unicoloured reddish with slightly lighter mouth parts and legs; with a feeble shine; dorsum with moderately dense, long, subrecumbent and contrasting conspicuous yellowish golden hairs, length of which is nearly 3 times more than the distance between their roots; ventral surface with somewhat short and finer, slightly conspicuous hairs, length of which about twice more than their roots; pronotal and elytral sides moderately ciliate.

Head and pronotal surface with punctures about 1.5 times as large as eye facets, interspaces between them nearly a third puncture diameter, densely and cellularly microreticulated. Elytral surface with shallower, smaller, more sparse and less distinct punctures than those on head and pronotum, interspaces between them larger, but as reticulated as those on head and pronotum. Pygidial surface densely and finely punctured, with narrow interspaces densely and cellularly reticulated. Surface of thoracic sterna and 1—4 ventrites with distinct punctures nearly as large as eye facets, interspaces between them 1.5—2.5 puncture diameters, smoothed or smooth on thoracic sterna and reticulated on ventrites. Hypopygidial surface similar to that on 1—4 ventrites, but punctures much larger and with narrower interspaces. Head 1.5 times shorter than the distance between eyes, composed of rather small facets, and concave between antennal insertions. Antennae a little shorter than head broad with 3-segmented and compact club. Mandibles moderately exposed from under frons and labral lobes deeply and widely separated. Maxillar and labial palpi with moderately developed segments, last ones of labial palpi slightly bulbous with oblique apex. Mentum pentangular 2.5 times as wide as long. Pronotum with slightly and evenly convex surface, with a narrow border along base and sides. Elytra steeply sloping to narrowly bordered sides and to acute apices, almost completely covered pygidium. Pygidial apex almost transverse and remaining uncovered angular apex of anal sclerite. Antennal grooves quite distinct and convergent along inner sides.



Figs 38—46: *Brounthina aequalis* gen. et sp. n. Male: 38 — body from above; 39 — fore part of head with labral lobes, dorsal; 40 — antennal club; 41 — fore tibia, dorsal; 42 — prosternal process, ventrally; 43 — idem, laterally; 44 — tegmen, ventral; 45 — penis trunk, dorsal; female: 46 — ovipositor, dorsal. Scales: A — to fig. 38; B — to figs 39—43; C — to figs 44—46.

Prosternum slightly convex with a process moderately medially curved and almost vertically abrupt at apex. The distance between mid coxae a little more than that between fore ones and that between hind ones, in turn, a little more than the distance between fore coxae. Mesosternum rather excavated and a medial carina at bottom. Metasternum flattened, with well raised medial suture and shallower emargination of hind edge between coxae. Intercoxal line well expressed and disposed far behind fore edge of metasternum almost rectalinearly joining the middles of mid coxal cavities. Caudal marginal lines behind mid coxae well expressed and forming a moderately large triangle at fore corner of metasternum (laterosternite). Caudal marginal line behind hind coxal cavities gently and archedly deviated in medial part of hind edge of coxae and returned to it at the middle of cavity. Hypopygidium 1.5 times longer than 1st ventrite and with distinctly angular apex. Legs rather stout and short. Tibiae triangular: fore one 1 and $^{1}/_{3}$ wider than antennal club and finely crenulate along outer edge; mid and hind ones a little wider than antennal club and

with 2 longitudinal rows of not dense, rather long and moderately thick hairs along their outer edge. Femora with usual outlines of gently convex fore and hind edges: fore one nearly as wide as, mid and hind ones 1.5 times wider than corresponding tibiae. Fore tarsi nearly as wide as antennal club, but mid and hind ones much narrower, with simple and long claws. Aedeagus well sclerotized.

Female. Externally differs from male by narrower fore tibiae and tarsi (former as wide as and latter narrower than antennal club), widely rounded pygidial and hypopygidial apices. Ovipositor moderately sclerotized.

Variation. Length 2.7—5.0 mm. General coloration varies from light reddish to dark brown, frequently with more or less lightened pronotal sides and appendages, or sometimes scutellar parts of elytra and head also lightened. Large specimens are with comparatively wider pronotal and elytral bases and more narrowed sides of pronotum anteriorly and elytra posteriorly. Elytral surface frequently has a rasp-like view. Pubescence in many specimens recently collected strongly contrast. Some variations are expressed in punctuation and sculpture of surface.

Notes. This monotypic genus has an intermediate position between the genera *Idaethina* Reitter, 1875 from Australia and *Neopocadius* Grouvelle, 1906 from Argentina, but differs from both groups by more deeply excised labrum, carinate mesosternum, well expressed intercoxal line disposed far behind fore edge of metasternum, more approached one to another hind coxae and characteristic genital structures in both sexes. Besides that, *Braunthina aequalis* gen. et sp. n. is distinct from the first also by unhaired eye facets, uniform elytral punctuation and weak sexual dimorphism in tibial shape, and from the second — by character of dorsal punctuation and pubescence and unwidened apex of prosternal process.

Generic name of this new genus is created to be devoted to T. Broun who more successfully investigated the Coleoptera of New Zealand than anyone before him.

13. Subgenus *Olliffura* Jelinek & Kirejtshuk, 1986 was proposed in Kirejtshuk (1986a).

14. Genus *Strongyllodes* Kirejtshuk, 1992 is mainly distributed in the Madagascarean, Indo-Malayan and Australian regions coming to the north up to Korea and Russian Far East. This genus is quite distinctly separated from the Mediterranean *Xenostrongylus* Wollaston, 1854 by more strongly and evenly convex oval body, less anteriorly projected head and especially elytral epipleura steeply sloped downwards.

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Zusammenfassung

Die Arbeit behandelt das mehrfache unabhängige Auftreten von Anthophagie bei verschiedenen Gruppen von Glanzkäfern der Familie Nitidulidae. Verlauf und Regelhaftigkeiten dieses Evolutionsprozesses werden dargestellt. Ähnliche Korrelationen in den Abwandlungen von Strukturen, Ernährungs- und Lebensweisen von anderen, nicht näher verwandten anthophagen Gruppen werden gezeigt. *Propetes* (*Propetes*) *aquilus* sp. n., *P.* (*P.*) *seychellensis* sp. n., *P.* (*Mandipetes*) *intritus* subgen. et sp. n., *P.* (*M.*) *longipes* sp. n., *Brounthina aequalis* gen. et sp. n., *Caplothorax* subgen. n. und *Plapennipolus* subgen. n. in der Gattung *Carpophilus* und *Urocarpolus* subgen. n. in der Gattung *Nitops* stat. n. werden als neue Taxa vorgeschlagen und beschrieben.

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Exceptional records of *Microgale* species (Insectivora: Tenrecidae) in vertebrate food remains

Steven M. Goodman, Paulina D. Jenkins & Olivier Langrand

Abstract. Records of *Microgale* species identified from scats and pellet remains of predators are reviewed. Cranial fragments of at least two individuals of *Microgale melanorrhachis* and a humerus of *M. talazaci* were identified from faeces of *Cryptoprocta ferox* collected at Montagne d'Ambre in northern Madagascar. Remains of *M. pusilla* were identified from *Tyto alba* pellets collected on the human-modified Central High Plateau near Antananarivo. The records of *M. pusilla* suggest that this species is not particularly sensitive to environmental disturbance.

Key words. *Microgale* spp., shrew tenrecs, prey remains, *Cryptoprocta ferox*, *Tyto alba*.

Introduction

Except for the study of Eisenberg & Gould (1970), conducted in the eastern rainforest of Madagascar, remarkably little has been published on the natural history and ecology of the shrew tenrecs (Family Tenrecidae, Subfamily Oryzorictinae) [sensu Hutterer (1993)]. In his recent revision of the genus *Microgale*, MacPhee (1987) summarized information on the distribution and habitat requirements of this genus based on museum specimens. Further, he identified remains of *Microgale* species from owl pellets, and in several cases these records represented exceptional range extensions and expanded our knowledge of shrew tenrec habitat requirements.

In general, using standard trapping techniques *Microgale* species are relatively difficult for mammalogists to capture. The presence of *Microgale* remains in predators' food remains allow insight into the distribution of shrew tenrecs. In this paper we present some information on *Microgale* species found in the pellets of owls and the scats of carnivores, and discuss the implications of these data on the distribution and habitat specificity of shrew tenrecs.

Results and discussion

Scats of *Cryptoprocta ferox* Bennett, 1833. — On 15 April 1992, Dr. Chris Raxworthy collected four scats in the Montagne d'Ambre National Park (12°28'S, 49°11'E), 40 km S Antsiranana. The average annual rainfall in the park is approximately 3600 mm (Nicoll & Langrand 1989). The scats were found at 900 m, next to Petit Lac (also known as Matsabory Mahasarika), a crater lake that lies in the heart of the forest, on a large flat rock within 20 m of the forest edge. This site is known to be frequented by *Cryptoprocta* and its scats are easily distinguished from other native and introduced carnivores (Rasolonandrasana 1994). On the basis of size and context, the scats were identified as those of *Cryptoprocta.* The vegetation surrounding the lake is composed of undisturbed rainforest, with an average canopy height of 30 m, and some emergent trees reaching 35 m. The understory is open and botanically diverse.

The leaf-litter is thick and permanently moist.

Inside the scats, cranial and post-cranial remains of at least two *Microgale melanorrhachis* Thomas, 1882. The mandibular rami in which m3 are present show the characteristic shape of the talonid or the toothrows with distinct diastemata, both of which diagnose this species. The distal end of a humerus was also recovered from the scats. On the basis of size, this bone was identified as *Microgale talazaci* Major, 1896a.

In a recent study of the small mammals of the Montagne d'Ambre National Park, Raxworthy & Nussbaum (1994) listed *M. melanorrhachis* Morrison-Scott, 1948 and *M. talazaci*, as well as several other species in this genus, as occurring within the local forest. *M. melanorrhachis* was found between 1125 and 1250 m and *talazaci* between 660 and 1250 m. MacPhee (1987) treats *M. melanorrhachis* as a synonym of *M. cowani*, however Nicoll & Rathbun (1990), Raxworthy & Nussbaum (1994), Stephenson (1995) and Jenkins et al. (1996) consider these taxa as distinct species.

Little is known about the food habits of *Cryptoprocta*. Albignac (1973) noted that in the wild this carnivore preys upon insectivores, particularly *Tenrec ecaudatus* (Schreber, 1777). The presence of the *M. melanorrhachis* remains in the scats, an animal weighing on average 12.7 g (range 10.5—15.0 g, n = 14), shows that this carnivore consumes small prey.

Barn Owl (*Tyto alba*) pellets. — Two separate collections of fresh barn owl pellets (n = 18) obtained on the Central High Plateau near the capital city of Antananarivo (1300 m; 18°55'S, 47°31'E) contained the bone remains of *Microgale pusilla* Major, 1896b; a shrew tenrec weighing on average 3.0 g (range 2.6—3.9, n = 12). The first collection, which consisted of a minimum of two *M. pusilla*, was obtained in February 1993 on the outskirts of Antananarivo in the district of Mahazoarivo (18°56'S, 47°33'E) below a roost. The local habitat is mostly human habitation surrounded by a patchwork of small rice paddies, dense eucalyptus and pine plantations, and open fields. A collection obtained from this site in January—February 1992 has already been reported on by Goodman & Langrand (1993), but did not contain *Microgale* remains.

A second barn owl pellet collection, including a minimum of three *M. pusilla*, was obtained in mid-July 1992 near Ilafy (18°51'S, 47°34'E), at 1350 m, 13 km NE of Antananarivo, in an area of anthropogenic savanna with rice paddies in valley bottoms and eucalyptus and pine plantations and a few houses on higher ground. The only local natural vegetation consists of a few *Dracaena* and *Ficus* trees. The savanna grassland is burnt once or twice a year for grazing purposes. All of these remains were identified as *M. pusilla* on the basis of size, the shape of the talonid of m3, and tooth socket structure.

Nothing is known about the hunting range of *Tyto alba* on Madagascar or for that matter on the African continent (Fry et al. 1988). In Europe it probably does the majority of hunting within the breeding territory, which varies from 0.4—2.5 km^2 depending on food availability (Cramp 1985). Thus, it is assumed that the prey found in the remains reported herein were taken in the immediate vicinity of the roost sites.

MacPhee (1987) noted that the majority of *M. pusilla* museum specimens came from the eastern rainforest, but there are several "anomalous" records of this animal elsewhere on the island. These include remains found in owl pellets collected along the Mahafaly Plateau (100—200 m), an area in southwestern Madagascar with sub-

arid thorn scrub and no permanent marshes (MacPhee 1986, 1987); at Antsiforakely (1600 m), a locality on the Central High Plateau with little remaining natural forest, but relatively extensive wetlands (MacPhee 1987); and near Antsirabe (1500 m), also on the Central High Plateau, surrounded by little natural habitat except for marshland (Major 1897). On the basis of this information, *M. pusilla* occurs in a wide variety of habitats, including non-forested areas and heavily modified agricultural zones. This same pattern has also been found for other shrew tenrecs, namely *M. cowani*, *M. dobsoni* Thomas, 1884, and *M. brevicaudata* Grandidier, 1899 (Kaudern 1918, MacPhee 1987).

In deforested zones of the Central High Plateau several *Microgale* species, which were previously thought to be forest dependent, persist in areas with extensive anthropogenic habitat modification. Presumably populations of these species remain in marshlands or small vestige patches of forests. Further, *M. cowani*, *M. dobsoni*, and *M. pusilla* are known from some of the remaining forests on the Central High Plateau, which are fragmented (Stephenson et al. 1994). These *Microgale* species cannot be used as "biological indicators" of undisturbed habitat. Other samples of barn owl pellets collected in heavily modified areas of the eastern rainforest and Central High Plateau have not yielded *Microgale* remains (Goodman & Langrand 1993, Goodman et al. 1993), and thus, there is either considerable seasonal or individual variation in the food habits of this owl, or remnant populations of *Microgale* species are exceptionally patchy in distribution.

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Zusammenfassung

Die Autoren berichten über Funde von Tenreciden der Gattung *Microgale* in Karnivorenkot und in Eulengewöllen. Schädelreste von mindestens zwei Individuen von *Microgale melanorrhachis* und ein Humerus von *M. talazaci* wurden in Kotproben von *Cryptoprocta ferox* identifiziert, die in Nord-Madagaskar in der Montagne d'Ambre gesammelt wurden. Reste von *M. pusilla* fanden sich in Gewöllen von *Tyto alba*, die auf einem degradierten zentralen Hochplateau nahe Antananarivo gesammelt wurden. Die Funde von *M. pusilla* deuten darauf hin, daß diese Art nicht besonders empfindlich auf Umweltveränderungen reagiert.

Résumé

La mention de deux espèces de *Microgale*, dont la présence a été mise en évidence par l'analyse des fèces ou des pelotes de rejection de prédateurs, fait l'objet d'une revue. Des fragments de crâne d'au moins deux individus de *Microgale melanorrhachis*, ainsi qu'un humérus de *Microgale talazaci* ont été identifiés à partir de fèces de *Cryptoprocta ferox* collectés à la Montagne d'Ambre, dans le nord de Madagascar. Des restes de *M. pusilla* ont été trouvés dans des pelotes de *Tyto alba* collectées dans un milieu fortement anthropique, localisé sur les Hauts Plateaux près d'Antananarivo. Ces dernières données suggèrent que *M. pusilla* n'est pas particulièrement sensible aux changements environnementaux.

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Systematics and biogeography of the southern African scincine genus *Typhlacontias* (Reptilia: Scincidae)

Wulf D. Haacke

Abstract. *Typhlacontias* is one of several fossorial skink genera of southern Africa, which are limbless or have degenerate limbs. It occurs in parts of the Namib Desert and the northern Kalahari Basin. In this generic revision six species, one with three subspecies, are recognised. The confused description of *T. punctatissimus* (Bocage, 1895) which has previously been addressed by Andersson (1916), is further discussed. *T. bogerti* Laurent is relegated to subspecies level of above species and *T. p. brainei* is described as a new and third subspecies. An apparently new species is recognised as one which was described as *T. johnsonii* in 1916 already. *T. rudebecki* is described as a new species and *T. gracilis* Roux, *T. rohani* Angel, as well as *T. brevipes* FitzSimons, are each treated as full species.

Key words. Reptilia, Scincidae, *Typhlacontias*, new species and subspecies, systematics, biogeography, southern Africa, Namib desert, Kalahari.

Introduction

The genus *Typhlacontias* was correctly identified as new by Bocage (1873) and only De Witte and Laurent (1943) attempted to split it when they proposed the genus *Fitzsimonsia* for *T. brevipes*. As the original syntypes of the type species *T. punctatissimus* were poorly preserved subadults, Bocage (1895) felt that the species description had to be amended when he received an assumed adult topotype in 1884. However, this was an aberrant specimen of a new species, later described as *T. johnsonii* (Andersson, 1916), and its supernumerary supranasal scales were considered species specific (Bocage 1895, pl.VII, Fig. 3; De Witte & Laurent 1943, Fig. 53). As a result *T. punctatissimus* became unidentifiable. Andersson (1916), recognising this confusion when he was supplied with seven additional specimens representing both species from the type locality, rediscribed *T. punctatissimus* on the basis of a single juvenile and utilised the other six specimens to describe a new species, *T. johnsonii*, in a paper which was overlooked ever since its publication. A point of controversy is the presence of leg rudiments in this *T. punctatissimus* neonate (HB = 41 mm), in a supposedly limbless species (Bocage 1873; Boulenger 1887). To complicate matters further, Bocage's (1895) three original specimens were destroyed in a fire in the sixties, shortly after Dr D. G. Broadley was able to re-examine the third specimen (= *T. johnsonii*) and confirm the accuracy of Bocage's (1895) description (Broadley, pers. com.).

In 1907 Roux described *T. gracilis* from a single specimen from Barotseland in Zambia, the former Northern Rhodesia (vide "Rhodésie" in De Witte & Laurent 1943: 35). The drawings of the head scales (Roux 1907: 84, fig. 3 and 4) are not very accurate, suggesting the presence of only four upper and three lower labials and the parietal area in the dorsal view is inaccurate. In addition the type has a slightly

aberrant supraorbital area as the upper anterior temporal scale apparently fused with the third supraorbital (Fig. 4b).

Another new species, *T. rohani* (Angel 1924), was described from the Kalahari sand of south-eastern Angola, but was overlooked by FitzSimons (1932) when describing *T. ngamiensis*. As a consequence the latter has been relegated to a junior synonym (Auerbach 1987).

Unfortunately the origin of the type of *T. brevipes* was not known when FitzSimons (1939) described this species. The assumption that it came from Angola resulted in the omission of this species from his classic study "The Lizards of South Africa" in 1943. McLachlan (1984: 17) eventually restricted the type locality to Walvis Bay.

After the second World War a revival of the interest in faunal studies of southern Africa took place and possibly an improvement in funding provided a new impetus for exploring and collecting. Fresh material was produced from the central and northern Namib when Dr Charles Koch and Dr C. K. Brain of the Transvaal Museum and Dr G. Rudebeck of the Lund University Expedition visited those areas and *T. bogerti* was described from south western Angola by Dr R. F. Laurent in 1964. The author of this paper then started collecting during the sixties, intensively sampling the Namib Desert, as well as the Kalahari in north-eastern Namibia and Botswana. Dr D. G. Broadley in Rhodesia (now Zimbabwe) also entered the arena at that time and accumulated long series with the help of enthusiastic amateurs like Richard Japp in western Zambia and the Caprivi Strip of Namibia. Distribution gaps in south-western Zambia and south-eastern Angola still cast doubt at some of the conclusions drawn in this paper.

A special problem is provided by the single, mutilated type specimen of *T. rudebecki* sp. n., which does not quite fit into the biogeographic picture of *Typhlacontias* as produced by the other taxa. However it is hoped that this study is a step in the right direction.

Genus *Typhlacontias* Bocage

Typhlacontias Bocage, 1873. Jorn. Sci. Lisboa 15: 213 (Type species: *Typhlacontias punctatissimus*). Boulenger 1887: 429; Bocage 1895: 56; Andersson 1916: 18; De Witte & Laurent 1943: 34; Greer 1970: 14; Welch 1982: 79.

A small genus of mostly apodal, fossorial skinks. The snout is flattened, protruding and covered by a large rostral scale. Nostrils pierced in the sides of the rostral, with a suture extending backwards to the edge of the rostral. A small to minute oblong postnasal scale is enclosed in this rostral groove. Three transversally enlarged azygous shields, i.e. internasal, frontonasal and frontal, cover the head between the rostral and the large subtriangular interparietal, in which a pineal eye is usually clearly visible. Eyes, small and completely exposed to partly covered, without eyelids, in contact with specific combinations of the second and third upper labials. Three pairs of temporal scales dorsally to the three posterior upper labials. No external ear opening. Body scales smooth, imbricate and in 18 rows around body. Tail length varies according to species from two thirds to one quarter of the body length. No preanal or femoral pores, sexes indistinguishable externally. The skull was discussed by Greer (1970: 14). Pectoral girdle strongly degenerate with no visible remnants of limbs, while the remains of the pelvic girdle may still have rudiments of the femurs. External leg rudiments consistently present in one species and occasionally so in another. Small conical teeth, palate toothless. Tongue squamous, anteriorly notched to slightly bifurcate.

Active sand swimmers patrolling leaf litter and decaying vegetable matter for termites, beetle larvae and other small invertebrate prey. Mostly active at night when soil temperatures allow near surface activity. Biology practically unknown but some species are ovoviviparous.

Range: The Namib Desert sands from north of Lüderitz into south western Angola and Kalahari sand of north-eastern Namibia, northern Botswana, western Zimbabwe and western Zambia. Although only one record exists from south-eastern Angola it is highly likely that these lizards are of common occurrence there.

Remarks: The original generic description was based on two poorly preserved syntypes (Bocage 1873) collected by the well-known naturalist J. O. Anchieta at the Curoca River mouth in the northern Namib Desert in Angola which were donated in 1867. A third, supposedly topotype, was added later and was used to expand the species description (Bocage 1895). It is now clear that the latter was an aberrant individual of *T. johnsonii* Andersson, 1916, a then still undescribed species, which caused confusion. All three specimens were destroyed by a fire in the Bocage Museum at the University of Lisbon during the seventies (D. G. Broadley, pers. com.). *T. punctatissimus* remains the type species and its original description (Bocage 1873; Boulenger 1887) was reviewed and updated by Andersson (1916: 21). Unfortunately the specimen, which the latter author considered to represent this species, is also aberrant as it has hindlimb rudiments.

Material

For this revision 616 specimens have been examined, including the types of *T. brevipes*, *T. gracilis*, *T. ngamiensis*, *T. rohani* and two syntypes of *T. johnsonii*. To save printed space only the specimens of new taxa and lectotypes are individually listed with catalogue number, while for every locality the institution in which a relevant voucher specimen is kept is listed. The following institutional abbreviations are used: CAS = California Academy of Science, San Francisco. EMUS = John Ellerman Museum, University of Stellenbosch. FMNH = Field Museum of Nat. Hist., Chicago. GMS = Gothenburg Museum, Sweden. IRB = Institut Royal des Sciences Naturelles, Brussels. LACM = Los Angeles County Museum, Los Angeles. MCZ = Museum of Comparative Zoology, Boston. MHNP = Museum of Nat. Hist., Paris. NDRS = Namib Desert Research Station, Gobabeb, Namibia. NMZ = National Museum, Bulawayo, Zimbabwe. SAM = South African Museum, Cape Town. SMF = Senckenberg Museum, Frankfurt on Main. TM = Transvaal Museum, Pretoria. ZFMK = Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn.

Key to the genus *Typhlacontias*

1a)	A strongly enlarged second lower labial present	2
b)	No enlarged lower labials	7
2a)	Rudimentary hindlimbs present	3
b)	No rudimentary limbs present	4
3a)	Minute postnasal scale in short contact with 1st upper labial, S of Kunene River	*T. brevipes*
b)	Minute postnasal scale enclosed within rostral suture, N of Kunene River	(*T. punctatissimus* ssp.)
4a)	Frontal shield subhexagonal to oval shaped, tail about one quarter of head/body length	*T. johnsonii*
b)	Frontal nearly halfmoon shaped with a strongly curved anterior edge and a nearly straight posterior margin. Original tail about two thirds head/body length	(*T. punctatissimus* sspp.) 5
5a)	Five upper labials with second usually reaching eye	*T. p. brainei*
b)	Six upper labials with second plus third or third only reaching eye	6
6a)	Usually only third upper labial reaching eye	*T. p. punctatissimus*
b)	Usually second and third upper labial reaching eye, southern Angola	*T. p. bogerti*
7a)	Third upper labial entering eye	*T. gracilis*
b)	Second upper labial entering eye	8
8a)	Loreal in contact with second upper labial	*T. rohani*
b)	Loreal not in contact with second upper labial	*T. rudebecki* sp. n.

Systematic account

Typhlacontias johnsonii Andersson (Figs 1a, 2a, 7)

Typhlacontias johnsonii Andersson, 1916. Meddel. Göteborgs Mus. Zool. Afdel. 9: 19. Lectotype Re. ex. 1388a, Lectoparatypes Re. ex. 1388b-f in Gothenburg Museum of Natural History (Type locality: Porto Alexander = Tombua, coll. by D. F. d'Azinhaes, 3 July 1912, don. by H. Skoog).
Typhlacontias punctatissimus part. Bocage 1895: 56. Roux 1924: 164. Monard 1937: 86. De Witte & Laurent 1943: 34, fig. 53.

Material: 83 specimens examined. Types in Gothenburg Natural History Museum. Two lectoparatypes seen.

Type series: The description is based on six syntypes, all recorded under No. 1388 in the Zoological Department of the Gothenburg Museum (now 'Naturhistoriska Museet, Göteborg', Sweden). The largest and first mentioned specimen (HB = 123 mm) of this series, of which the measurements are listed (Andersson 1916: 20) is hereby designated as lectotype (1388a), while the remaining smaller individuals are lectoparatypes (1388b-f).

Etymology: Named in honour of Mr. C. O. Johnson, who financed Mr. Skoog's expedition to Angola.

Diagnosis: Tail shorter than in all other species, i.e. about 25 % of SV length. Eye smaller than in other species and partly overlain by edges of loreal and supraocular. Second upper labial about twice as long as tall and in contact with eye.

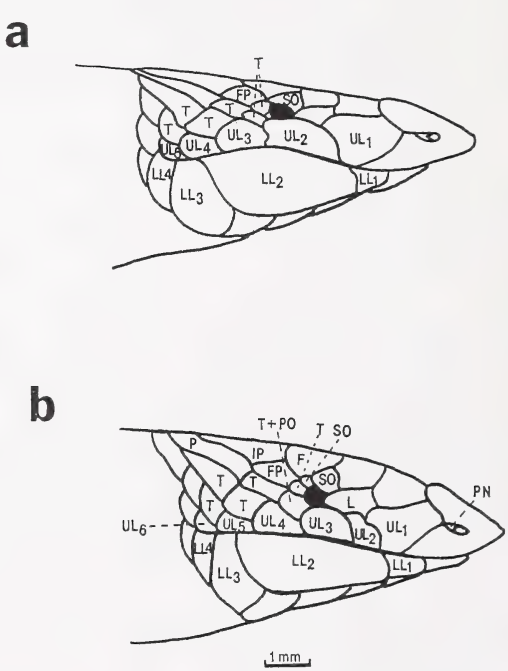

Fig. 1: a) *Typhlacontias johnsonii* Andersson, TM 63455, Ondondujengo River, Namibia; b) *Typhlacontias brevipes* FitzSimons, TM 31416, Unjab River, Namibia. Postoculars fused with temporals. (For abbreviations see Fig. 5).

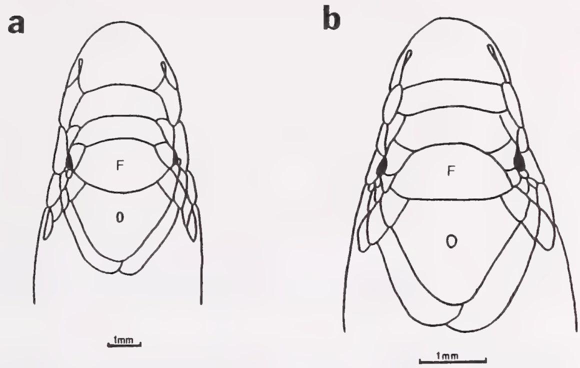

Fig. 2: a) *Typhlacontias johnsonii* Andersson, TM 63455. Data as above; b) *Typhlacontias punctatissimus bogerti* Laurent, NDRS-R 223, Curoca River crossing, Angola. Dorsal view to illustrate the difference in the shape of the frontal shield.

Description: Body relatively stout, underside of body flattened. Head wedge-shaped, snout depressed, rostral forming sharp horizontal edge. Relative size of laterally deeply notched rostral less prominent than in other species. Nostrils connected to rear edge of rostral by short suture, enclosing small oblong postnasal scale. Rostral followed by bandlike internasal and frontonasal, a suboval to hexagonal frontal, a large subpentagonal interparietal flanked by pair of striplike parietals which touch behind interparietal (Fig. 2a). Pineal eye in interparietal usually visible. Five upper labials, first largest, second very long and below eye, probably consisting of the fused second and third. Eye exposed but small, with a nearly straight posterior edge, partly covered by second upper labial and the single, large, triangular supraocular, resulting in a subtriangular appearance (Fig. 1a). Eye also in touch with loreal (= preocular according to Andersson 1916), occasionally a tiny single preocular, the upper anterior temporal which may have fused with the upper postocular and a tiny lower postocular, which may be missing. Frontoparietal in contact with upper anterior temporal. Large mental followed by large postmental, four lower labials of which the second is very large. Head scales show a certain amount of individual variation, s. a. subdivisions of dorsals (eg. frontonasal in TM 63344 and supernumerary postnasals in original specimen from Curoca River [Bocage 1895: 56]), minute preoculars may be present or partly obscured by loreal, labials may be split in two or scales may fuse.

Row of four preanal scales, subequal in size to the ventrals. Eighteen rows of tight-fitting smooth scales covering body.

Cleared specimen TM 63463 (Ondondujengo River) has 72 spinal vertebrae, remnants of pectoral and pelvic girdles present but no limb rudiments.

Ventrals: Range = 131—150, n = 73, $\bar{x}$ = 139.2, SD = ± 5.1. Subcaud.: Range = 35—42, n = 50, $\bar{x}$ = 38.4, SD = ± 2.5.

Size: Max SVL = 117 mm (TM 63461, Ondondujengo River). Max total = 139 (110 + 29) mm (TM 32569 56 km S of Orupembe). Min SVL = 39 mm (TM 63281 Hartmann's Valley). Min total = 51 (41 + 10) mm (TM 63373 Hartmann's Valley). Relat. tail length: Range = 23—33 %, n = 53, $\bar{x}$ = 26.8 %, SD = ± 2.4.

Colouration: Juveniles are pinkish pale yellow with only small sark spots on frontal and interparietal, an indication of a vertebral double line and a lateral line extends backwards through the eyes. The light dorsal areas on the snout may be light brown to golden yellow, with the tail pale blue. With maturity each scale's centre spot enlarges, black lines become more prominent and old individuals may become very dark. Apart from the unmarked lower jaw area every body and tail scale has a central dark spot. Size of spots variable and rows of

large spots create a dorsal band (2 rows), 1 dorsolateral line, a broad (3 rows) lateral band and often a black ventrum (4 rows). Dorsal band joins dark brown marks on top of head, lateral bands continue through eyes and join on snout.

Range: (Fig. 7) Wind blown sand of the Northern Namib Desert from the mouth of the Curoca River on the northern edge of the Curoca sand-sea in south-western Angola, southwards into the Kunene sand-sea in north-western Namibia. Documented as far south as the Sechomib River valley. In Namibia it avoids the coastal hummocks of the seaward side of the sand-sea where *T. brevipes* occurs. Although poorly documented in Angola it apparently occurs closer to the coast there. *T. brevipes*, which is of similar size and would therefore probably be in direct competition, has not been recorded from north of the Kunene River. On the inland edge of the Kunene sand-sea, it is usually sympatric with *T. punctatissimus* ssp., but only rarely with *T. brevipes* when the latter species extends that far inland along drainage valleys.

Distribution records: ANGOLA: Porto Alexander (= Tombua) 1511Dd (GMS); Curoca River (nr mouth) 1511Dd (Bocage 1895: 56); Lacrau 1711Bb (TM). NAMIBIA: Okotusu area 1711Bd, E edge of Kunene sand-sea 1712Ac and 1711Db, edge of Hartmann's Valley 1712Ac, 48 km NW of Ouhandjo 1712Ac (TM); Ondondujengo River at Hartman Valley — Cape Fria road crossing 1712 Cc (SMWN, TM, ZMFK); Sechomib River valley 56 km SSW of Orupembe 1812Da (TM, ZFMK); nr end of Hartmann's Valley 1712Aa (TM, SMWN); Hartmann's Valley 1712Cb (TM).

Field notes: Active during summer evenings mostly around debris accumulations at the base on the leeward side of dunes. Individuals move just below the sand surface, out of sight, leaving a clear regular undulating track. Occasionally these tracks move across the slipface to the crest of the dune, over the top or down again. When moving, although not actually exposed, the position of the specimen is quite clear under the surface at the blunt end of the track and collecting is easiest at that moment. If disturbed they dive into the sand and become inaccessible. As this material was mostly collected during autumn, no gravid females were found. However, a number of young (about 40 mm HB length) were collected during April 1985. It is assumed that this species is live bearing and the young are born during late summer i.e. February to March.

Typhlacontias brevipes FitzSimons (Figs 1b, 6)

Typhlacontias brevipes FitzSimons, 1939. Ann. Transv. Mus. 20: 15, figs 14—17. Type S.A.M. 508 in South African Museum, Cape Town. (Type locality: Cape Division. Restricted to Walvisch (= Walvis) Bay, Namibia by G. R. McLachlan 1984: 17). Greer 1970. Welch 1982: 79. Branch 1988: 124.
Fitzsimonsia brevipes De Witte & Laurent 1943: 11. Haacke 1964: 8.

Material: 141 specimens examined. Type seen.

Etymology: Referring to the presence of limb rudiments.

Diagnosis: Rostral large and laterally strongly notched with the small enclosed postnasal scale making contact with the first upper labial, third upper labial in contact with eye, second lower labial very large. Minute hindlimb rudiments visible on either side of cloaca.

Description: Snout depressed and covered by a large rostral scale which extends beyond the lower jaw and forms a sharp horizontal edge, strongly notched laterally. Edges of nasal suture in rostral scale not touching as small postnasal scale is in contact with the first upper labial. The three bandlike scales i.e. internasal, frontonasal and frontal are subequal in width and breadth, large subpentagonal interparietal is posteriorly edged by a pair of striplike parietals, which slightly overlap. The pineal eye is usually clearly visible in the interparietal, but not so in the four most southern specimens from Groot Anigab (TM 44320-3). Six upper labials, first largest, third touching eye, sixth smallest. Eye small and round, bounded and partly overlain by the third upper labial, loreal, two supraoculars, the upper anterior temporal and a tiny lower postocular. Large mental and postmental, four lower labials with second very large. Body scales smooth, tight-fitting, imbricate in 18 rows. A minute rudimentary hindlimb, present on both sides of the vent. Cleared specimen TM 27450, Swakopmund, has 66 and TM

56876, Hoanib Oasis, has 68 vertebrae, remnants of the pectoral and pelvic girdles, with femur rudiments.

Ventrals: Range = 133–152, n = 95, $\bar{x}$ = 140.3, SD = ± 4.6. Subcaud.: Range = 45–56, n = 56, $\bar{x}$ = 52.0, SD = ±3.2.

Size: Max SVL = 133 mm (TM 36886 Walvis Bay). Max total = 158 (125 + 33 dam.) mm (TM 42252 10 km SE of Torra Bay). Min SVL = 39 mm (TM 63349 Ondondujengo River). Min total = 54 (39 + 15) mm (TM 63349 Ondondujengo River). Rel. tail length: Range = 32–44 %, n = 55, $\bar{x}$ = 37.6 %, SD = ± 2.7.

Variation: A considerable amount of individual variation occurs amongst the head scales, especially the smaller ones around the eyes, which may be absent or fuse with adjacent scales. Fusions may be symetrical or not. For example, TM 31529 (Munutum River) has both loreals fused to the internasal forming one wide halfmoon-shaped band. Amongst the specimens from just south of the mouth of the Kunene River, the size of the second upper labial, which is usually in touch with the loreal, is reduced to such an extent that the first and third upper labials are in contact above it. The development of the limb rudiments is fairly consistent. The total size, even in big adults, tends to be less than a millimetre in length, although the shape may vary from blunt triangular to slightly elongated.

Colouration: Juveniles have well developed dark lateral bands at an early age, a faint dorsal double line which starts on the head, down the yellow-grey back. With increasing size every scale develops a dark blotch to an extent that the specimen is more or less lined but then gets evenly speckled as the dark lines become less distinct. The background colour of back and body may be silver grey to pale straw yellow with the tail pale powder blue. Individuals from Gobabeb on the Kuiseb river are much lighter than the coastal specimens. Most of these specimens have an unmarked light sulphur yellow body with only a few vertebral rows of dark spots. The tails are darker marked with rows of dark specks on a blue-grey background.

Range (Fig. 6): Coastal Namib Desert from just north of Lüderitz to the Swakop and then the Omaruru River. No records are known from the Omaruru River to the southern tip of the northern sand-sea, where the road to Khorixas turns inland. Northwards from that point this species is quite common in vegetation islands and hummocks on the seaward side of the large sandbodies as far as the mouth of the Kunene River. It may extend inland along the drainage valleys of the dry rivers.

Distribution records: NAMIBIA: Cape Fria 1812Ac (TM); Cape Fria or Karlowa's Hut 1812Aa (SMWN, TM); 'Dunedin Star' Wreck 1811Bb (TM); Gobabeb 2315Ca (CAS, MCZ, SMWN, TM, ZFMK); Great Anigab Waterhole 2615Ac (TM); Hoanib River flood plain 1912Bd (SMWN); Hoanib River mouth 1912Bd, Hoanib/Mudorib River confluence 1913Ad, Hoanib River at 1913Ac (TM); Hoarusib River mouth 1912Ba (SMWN); 18 km NW of Hunkab River crossing 1913Ca (TM); Khumib River mouth 1812Cd (SMWN); Kuiseb River dunes at Rooibank 2314Ba (SMF); S of Kunene River 8 km from mouth 1711Bd, Möwe Bay area 1912Bc (SMWN, TM); Munutum River 16 km from mouth 1812Ac (SMWN); Munutum River 40 km from Cape Fria 1812Aa, 'Oasis' in Hoanib River 1912 Bc (TM); Omaruru River 16 km from mouth 2114Cd (SMWN, TM); Ondondujengo River 1712Cc (TM); Rocky Point 1812Cd (SMWN); Samanab River 2013Ab, Sandwich Harbour 2314Ad (TM); Sarusas in Khumib River 1812Cd, Sechomib River 1812Ad (SMWN, TM); Swakopmund 2214Da (LACM, TM); Swakop River 2214Da (TM, CAS); Terrace Bay 1913Cc (TM); Torra Bay 2013Ac (SMWN); 10km and 22km SE of Torra Bay 2013Ad, Unjab River at 2013Aa, Ab (SMWN, TM); 8 km E of Walvis Bay 2214Dc, 10 km S of Walvis Bay 2315Ba (TM).

Field notes: This species avoids large bare sand bodies and is usually found in the semistable sand of hummocks and sparsely vegetated dunes, as well as the edges and sandy vegetated banks of dry rivers. In general it does not share its habitat with other fossorial lizards. At Gobabeb, the furthest inland record, *T. brevipes* occurs along the banks of the Kuiseb River and although it is sympatric with *Typhlosaurus braini* there, the latter avoids direct competition by utilising the occasional hummocks on high dunes. However, near Groot Anigab, the currently documented southern range limit of both species, these two species were actually found in the same hummock. South of Torra Bay open valleys are crossed on shifting, barchan dunes which also carry *Meroles* (*Aporosaura*) *anchietae* and *Bitis peringueyi*. Only when

T. brevipes penetrates the northern sandseas along riverbeds towards the eastern side of the dunefields, has it been found to be sympatric with other legless lizards, such as *T. johnsonii* and *T. punctatissimus*. This species, like other congenerics, tends to feed and be active just below the sand surface at night and during the twilight hours when the sand is of a suitable temperature. They leave their undulating tracks all over the windblown sand of dunes and hummocks, feeding on a variety of small insects, their larvae and occasional termites. Although dune slipfaces and debris accumulations are patrolled and frequented, *T. brevipes* appears to prefer vegetated hummocks and their leaf litter cushions. Most small juveniles (about 40 mm HB length), which appear to be neonates, were found during March to April. TM 44320, a large female (HB = 110 mm) from Groot Anigab, collected during January contained three well developed foetuses, which suggests that they were probably ready to be born during the latter part of summer, i. e. February to March.

Typhlacontias punctatissimus Bocage

The original description was based on a pair of poorly preserved subadult syntypes (Bocage 1873). Although referring to them as "limbless", their state of preservation may have caused the author to overlook some of the finer details. Possibly due to a typographical error the presence of a subocular instead of a supraocular was described (Boulenger 1887). The species description was extended (Bocage 1895: 56) when an apparent adult topotype became available. An important aspect of this specimen was the presence of a pair of small supranasals, now recognized as an individual variation, as it has not been recorded again. This fact was considered as species specific and was used by Monàrd (1937: 84) and De Witte & Laurent (1943: 34) to differentiate *T. punctatissimus* from other species. Due to this compound description *T. punctatissimus* became unidentifiable. These three specimens were destroyed by fire in the Museo de Bocage at the University of Lisbon (acc. Prof. Saccarao, D. G. Broadley pers. com.) in the seventies, just after Broadley had the opportunity to re-examine the third specimen and confirm the correctness of its description (Broadley, pers. com.). Although the original syntypes have never been re-examined because of their poor condition, the description (Bocage 1873) contains a number of points, which are significant for the recognition of this species. The shape of the frontal scale was described as being "large and almost semicircular with the anterior edge rounded and posterior edge straight". This shape is typical for *T. puncatissimus* (Fig. 2) and differentiates it from the assumed adult topotype which was actually a different species. The aspect providing absolute proof that another species was involved are the body ratios. The relative tail length of the longer of the former syntypes was equal to 51 % of HB length (Bocage 1873: 213), which is typical for *T. punctatissimus* (Table 1), whereas in the third or "adult" specimen the tail was only 26 % of the body length, which is diagnostic for *T. johnsonii* (Bocage 1895: Fig VII, 3+3a. Table 1). Seven new specimens from the type locality, donated by H. Skoog in 1912, were examined by Andersson (1916) and it was obvious to him that two species were involved. According to a single neonate (Re. ex. 1389, HB = 42 mm) he confirmed the original description of *T. punctatissimus* (Bocage, 1873) and redescribed

Table 1: Variation in size, body proportions and scalation.

Species	n	max SVL	% T/SVL		Ventrals		Subcaudals		Vertebrae
			Range	Mean	Range	Mean	Range	Mean	
T. brevipes	104	133	32—44	37.6	131—152	140.3	42—56	51.6	66, 67, 68
T. johnsonii	86	117	23—33	26.8	131—150	139.2	35—42	38.4	72
T. p. bogerti	29	86	46—55	51.9	114—135	122.7	59—69	62.3	62
T. p. punctatissimus	39	84	44—62	51.9	116—137	124.6	50—70	60.9	61
T. p. brainei	12	70	45—60	51.5	117—128	122.3	50—68	59.3	—
T. gracilis	112	84	40—61	50.2	122—147	134.7	60—65	62.5	68
T. rohani	233	90	48—73	57.0	124—146	134.3	64—84	69.4	62,63,66
T. rudebecki	1	82	—	—	157	—	—	—	—

it. He added to the controversy by recording the presence of tiny leg rudiments in this specimen, which has now been made available for re-examination and the presence of these limb rudiments is herewith confirmed. Only a single additional specimen with tiny hindlimb rudiments (R 224 Namib Desert Research Station, Gobabeb, from eastern edge of the Curoca Sand Sea, S of Curoca River near road crossing into Iona National Park, 1612Ad, Angola) has been traced amongst the 94 specimens of this species that have been examined for this revision. One of two cleared specimens has internal femur rudiments (TM 40727, Kakolo windmill 1612Cd , Iona Nat.Park, Angola), while the second (TM 63481) from the Ondondujengo River (1712Cc) in Namibia has no indication of any rudiments at all. According to other external morphological characteristics the specimens from the Curoca River mouth and the Ondondujengo River represent the typical subspecies, *T. p. punctatissimus*, while the other two specimens mentioned represent *T. p. bogerti.*

Under normal circumstances leg rudiments carry substantial weight in species recognition of fossorial skinks. At present not enough material is available from the type locality in the vicinity of the Curoca River to evaluate the taxonomic significance in this case and it is for the time being accepted as atavistic intraspecific or individual variation.

Unfortunately Andersson's (1916) paper has been overlooked since then in all studies dealing with *Typhlacontias. T. bogerti* Laurent (1964) is only subspecifically distinct from *T. punctatissimus* and trinomens must thus be used. In addition a third subspecies can be defined and is described below.

Typhlacontias punctatissimus punctatissimus Bocage (new status) (Fig. 3b)

Typhlacontias punctatissimus Bocage, 1873. Journ. Sci. Lisboa 4: 213 (Type locality: Rio Curoca mouth, Moçâmedes district, Angola), 1887: 203 and 1895: 56 (Syntypes in 'Museo de Bocage', Lisbon, destroyed by fire). Boulenger 1887(3): 429. Andersson 1916: 21. Roux 1924: 164. Monard 1937: 86. De Witte & Laurent 1943: 34. Greer 1970: 14. Welch 1982: 79.

Typhlacontias bogerti, Haacke 1965: 22 (part. Namibian specimens). Mertens 1971: 70 (part. Namibian specimens).

Material: 39 specimens examined. Syntypes destroyed, not seen.

Etymology: Referring to its speckled colour pattern.

Diagnosis: The most slender of those species characterised by the enlarged second lower labial and the laterally strongly notched rostral, s. a. *T. brevipes* and *T. johnsonii.* Large frontal, nearly semicircular with straight posterior edge. In this subspecies usually only the third upper labial enters eye. Rudimentary hindlimbs may occur.

Description: The original description applies. Snout depressed, large rostral scale with horizontal edge, less strongly notched than in the above mentioned taxa. Nasal groove straight, enclosing minute postnasal scale. Rostral followed by a narrow striplike internasal, a slightly

Table 2: Variation in head scalation.

Species	Enlarged 2nd L.L	Upper labials	UL below eye	Supra oculars	Prefront present	PF in contact with FP	Loreal in contact 2nd UL
T. brevipes	X	6	3	2	—	—	X
T. johnsonii	X	5	2	1	—	—	X
T. p. bogerti	X	6	2 and 3	2	—	—	X
T. p. punctatissimus	X	6	3	2	—	—	X
T. p. brainei	X	5	2	2	—	—	X
T. gracilis	—	6	3	2	X	X	X
T. rohani	—	5	2	2	X	—	X
T. rudebecki	—	5	2	2	X	X	—

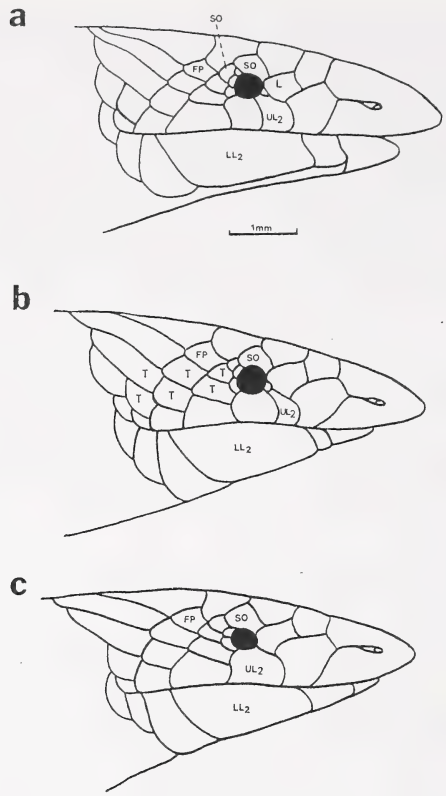

Fig. 3: a) *Typhlacontias punctatissimus bogerti* Laurent, topotype TM 40391, 34 km S of Namibé (= Moçâmedes), Angola, with supernumerary third upper postocular; b) *T. p. punctatissimus* Bocage, TM 63215, Munutum River crossing, Namibia; c) *T. p. brainei* ssp. n., holotype TM 68443, Khumib River, Namibia.

wider prefrontal and a fairly large semicircular frontal scale, which has a strongly convex anterior and nearly straight posterior edge (Fig. 2b). Eye round, completely exposed and bordered by one preocular, loreal, the anterior supraocular, two postoculars and the third upper labial, separated from second supraocular by upper postocular. Six, not five upper labials, first largest, second small and curving backwards but separated from eye by tiny preocular. The supposed presence of a subocular reported by Bocage (1873) appears to be due to a typographical error referring to a supraocular. No noticeably enlarged triangular preanal scales could be confirmed. The tiny hindlimb rudiments specifically mentioned by Andersson (1916) for the juvenile topotype (Re. ex. 1389), which was re-examined, are very distinct but could not be traced in any other specimens, except for one from further upstream along the Curoca River. In that case (D.E.R.U. R-224) the limb rudiments are even less well developed.

Cleared specimen TM 63481 (Ondondujengo River), has 61 vertebrae, remnants of pectoral and pelvic girdle, but no internal limb remnants.

Ventrals: Range = 116–137, $\bar{x}$ = 122.7, SD = ± 6.99, n = 27. Subcaud.: Range = 50–70, $\bar{x}$ = 62.3, SD = ± 2.99, n = 11.

Size: Max SVL = 84 mm (TM 24304 Nangolo Flats). Max total = 115 (77 + 38) mm (TM 63215 Munutum River). Min SVL = 38 mm (TM 63478 Ondondujengo River). Min total = 74

(49 + 25) mm (SMWN 8196 Hartmann's Valley). Rel. tail length: Range = 46—55 ‰, $\bar{x}$ = 51.9 ‰, SD = ± 6.21, n = 9.

Notes: The relative tail length of one of the original syntypes was 51 ‰ (HB = 55 mm, tail = 28 mm). This matches the mean for this taxon (Table 1), which also applies to the topotype (SVL = 41 mm, tail = 20 mm, rel. tail length = 49 ‰) (Andersson 1916: 22). This ratio for the third specimen, presumed to be an adult topotype (Bocage 1895), was "measuring about a quarter of the length of the body," i.e. 26.1 ‰ (HB = 92 mm, tail = 24 mm) which is typical for *T. johnsonii* (Table 1, Range 23—33 ‰, $\bar{x}$ = 26.8 ‰).

As the two syntypes were destroyed by fire it is desirable to designate a lectotype. However as the Curoca River is the type locality for this taxon and at the same time appears to be the border between two subspecies, it seems important that any action is avoided which might further contribute to the confusion. It is therefore highly desirable that a topotype should be used for this purpose. At present the only specimen of this taxon from that site and from north of the Kunene River is the above mentioned juvenile with the atypical limb rudiments. Although this is viewed as being an intraspecific apparently atavistic individual variation, it may also represent a situation of taxonomic importance, for which reason this individual is unsuitable as a lectotype. As this problem can only be resolved once additional topotypes become available, it is abstained from designating a lectotype.

Colouration: The basic patterns of this taxon are created by the black centre spots of each scale which may be more or less emphasized, thereby creating the impression of lines. The broad (4 scales) dorsal band may be unmarked and of a rich golden brown, but may vary via straw yellow to pinkish grey, in which case two vertebral lines of brownish specks occur. Laterally two well defined black lines start as one near the nostril, pass through the eye and extend to the tail tip. Additional lines of specks may be present ventrally and on the underside of the tail. Scales in cloacal area usually unmarked. On the silvery blue tail the two vertebral dark lines are more prominent than on the body. The top and sides of the head may or may not be marbled with brown, have a few dark spots or an arrow-headed brown mark.

Variation: Within the range of *T. p. punctatissimus* odd specimens occur with individual variations to the labial formula, such as asymmetrical fusions of labial 1 and 2 (TM 31525) and of 2 and 3 (TM 31525), symmetrical fusions of 1 and 2 (TM 63259) and of 2 and 3 (TM 57556), vertical subdivision of labials 2 and 5 in TM 71475 on the left side created eight upper labials and of these the fourth is in touch with the eye. These variations might produce problems when keying out individual specimens, but similar variations occur in the other two subspecies as well. A relatively significant variation is the rare presence of external rudimentary hindlimbs.

Range (Fig. 8): Although the original type locality was the lower Curoca River on the edge of the Curoca Sand Sea, only one further specimen is known from there. At present the typical form is mostly known from south of the Kunene River in Namibia, where it occurs from the inland edge of the Kunene Sand Sea into the Marienfluss Valley and as far south as the Munutum River. It is not known from the immediate vicinity of the Namibian coast.

Distribution records: ANGOLA: Curoca River nr mouth 1511Dd (Bocage 1873) and nr Porto Alexander (= Tumboa) 1511Dd, which is nr mouth of Curoca River (= Type locality). NAMIBIA: Hartmann's Valley, several records from close proximity to one another within the q.d.s. 1712Aa (SMWN, TM); 1712Ac (TM, ZMFK) and 1712Cb (TM); Khumib River (SMWN); Marienfluss 1712Da (SMWN, TM); Munutum River 40 km from Cape Frio 1812Ab (SMWN, TM); Muntum River at Skeleton Coast Park border 1812Aa (TM); Nadas River 32 km from Cape Frio 1812Ac (SMWN); Nangolo Flats in Marienfluss Valley 1712Ad (TM); Ondondujengo River 1712 Cc (TM, ZMFK); Okotusu area 1711Bd (TM); 16 km W of Orupembe 1812Ad (SMWN); Ouhandjo area 1712Ba (SMWN); 48 km NW of Ouhandjo 1712 Ac (TM).

Field notes: This species is not normally associated with the major sand seas. Although their regular undulating tracks may be seen in the larger sand accumulations of their range, they are more often found in small patches of sand on stony hillsides and specimens may actually be found under stones in the inland part of their range. In the sandy parts of the Hartmann's Valley this taxon is sympatric with *T. johnsonii* and only capture will allow identifica-

tion of the species which produced the track. As most other fossorial skinks, these lizards move just below the sand surface and exposures, as when a stony area is crossed, only rarely happen. It is as yet unclear what predators this species may have. No information about reproduction is available. The smallest juvenile (TM 63478) of 38 mm HB length, tail broken was collected during April 1985 indicating that parturition takes place during late summer.

Typhlacontias punctatissimus bogerti (new status) Laurent (Figs 3a, 8)

Typhlacontias bogerti Laurent 1964. Publ. cult. Comp. Diam. Angola 67: 82 (Type locality: '35 km S of Moçâmedes (= Namibé)', Angola. Types in Dundo Museum, Angola). Haacke 1965: 22 (part., Angolan specimens). Greer 1970: 14. Mertens 1971: 70. Welch 1982: 79.

Material: 29 specimens examined. Types not seen.

Etymology: Named in honour of renowned American herpetologist Dr Charles M. Bogert.

Diagnosis: A slender form with enlarged second lower labial scale and general characteristics described for the typical form but second and third upper labial in touch with eye.

Description: In general very similar to the typical form apart from the subspecific character, i. e. the second and third upper labial are in touch with the eye. This situation is fairly persistent amongst the series of 14 specimens from Moçâmedes (= Namibé), although individual variation occurs, such as the second upper labial being separated from the eye by the preocular as in the typical form (TM 24465, 24469, 24473), or the second upper labial may just be too short to reach (TM 24463, 24469). The Kakolo windmill sample (n = 7) may be seen as of an integrate population, as three are normal *T. p. bogerti*, but four have variations which do not allow the second upper labial to reach the eye. Usually two, rarely three postoculars.

Cleared specimen TM 40727 (Kakolo windmill), has 62 spinal vertebrae, remnants of the pectoral and pelvic girdles with tiny remnants of the proximal femur head, while R-224, in the collection of the Namib Desert Research Station, Gobabeb, from the eastern edge of the sand sea south of the Curoca River, has minute limb rudiments adjacent to the cloaca.

Ventrals: Range = 114—135, $\bar{x}$ = 122.7, SD = ± 6.99, n = 27. Subcaud.: Range = 59-69, $\bar{x}$ = 62.3, SD = ± 2.99, n = 11.

Size: Max SVL = 86 mm (TM 40725 Kakolo Windmill). Max total = 123 (83 + 40) mm (TM 40724 Kakolo Windmill). Min SVL = 40 mm (TM 40730 Kakolo Windmill). Min total = 58 (40 + 18) mm (TM 40730 Kakolo Windmill). Relative tail length: Range = 44—62 %, $\bar{x}$ = 51.9 %, SD = ± 6.21, n = 9.

Colouration: Similar to the typical form.

Range (Fig. 8): Northern Namib Desert of Angola in the Iona Park west of the Curoca Sand Sea and north to Moçâmedes (= Namibé).

Distribution records: ANGOLA: Curoca River crossing 1612Ad (NDRS); Kakolo Windmill 1612Cd, Moçâmedes (= Namibé) 1512Aa (EMUS, IRB, TM, ZMFK); 10 km S of Moçâmedes (= Namibé) 1512Ac, 34 km S of Moçâmedes (= Namibé) 1512Ca, (TM); 8 km SE of Pico de Azevedo 1512Da (SMWN).

Field notes: The types were collected under a stone and under a *Welwitschia* plant (Laurent 1964), as were those from 10 km S of Moçâmedes (= Namibé). In Moçâmedes specimens were found next to the trunk and amongst the roots of trees lining the streets (C. Koch, pers. com.). At the Kakolo Windmill the specimens were collected at night while they were active near the surface of red sand accumulations against a stony hillside. The large female paratype collected on 23 November 1949, contains embryos with well developed eyes (Laurent 1964: 84).

Typhlacontias punctatissimus brainei ssp. n. (Figs 3c, 8)

Etymology: Named after Mr Steve Braine, former ranger of the Skeleton Coast Park, Namibia, for his contribution towards the knowledge of the fauna of that area during his term of office there.

Holotype: TM 68443, collected by W. D. Haacke, 11. 4. 1989.

Paratypes: 15 specimens. TM 31497-8, Sechomib River Valley 29 km SW of Orupembe

(1812Ad) coll. W. D. Haacke, 4. 10. '65. TM 32375, same as previous specimens but 7. 5. '66. TM 56863, Hoanib River 2 km E of Amspoort, 19°20'S 13°12'E, coll. S. Braine 18. 9. '83. TM 68437—68442, ZFMK 57532, same data as holotype. SMWN 2011, Khumib River 16 km E of Sarusas East (1812Ba), SMWN 2014(3), 29 km SW of Orupembe 1812Ad, coll. W. J. Steyn 4. 10. 65.

Type locality: Khumib River 25 km from the coast, Skeleton Coast Park, Opuwo District, Namibia, 18°44'S 12°36'E (1812Da).

Diagnosis: In general appearance and characteristics similar to the typical form but upper labials 2 and 3 appear to have fused, resulting in five, instead of six upper labials and the large second upper labial is in contact with the eye. Preocular absent or minute and partly covered by loreal. Eye usually in touch with the least number of scales of all taxa, namely second upper labial, loreal, anterior supraocular and two postoculars.

Description: Holotype TM 68443, sex undetermined, 112 (70 + 42) mm, tail 60 % of HB length, 18 scale rows round middle, 120 ventrals, 68 subcaudals, five upper labials of which the large second (fused 2 + 3?) is in contact with eye, preocular absent or minute and covered by large loreal, two supraoculars form lateral edge of frontal and larger, anterior also in contact with upper edge of eye, two small postoculars, four lower labials of which the second is very large (Fig. 3c).

Variation: Similar to holotype with minor individual variations, s. a. second and third upper labials not fused on both sides (SMWN 2014c) and on right side only (SMWN 2011).

Ventrals: Range = 117—128, n = 12, $\overline{x}$ = 122.3, SD = ± 2.64. Subcaud.: Range = 50—68, n = 6, $\overline{x}$ = 61.8, SD = ± 5.63.

Size: Max SVL = 70 mm (TM 31498, holotype). Max total = 112 (70 + 42) mm (TM 31489, holotype). Min SVL = 41 mm (TM 56863, near Amspoort, neonate). Min total = 9 (41 + 18) mm (TM 56863, near Amspoort, neonate). Relative tail length: Range = 45—60 %, $\overline{x}$ = 51.5 %, n = 6, SD = ± 4.86.

Range: Recorded from the Sechomib to the Hoanib River valleys, just outside the border of the Skeleton Coast Park, Namibia, and not above an altitude of about 600 m a.s.l.

Field notes: Wind-blown sand accumulations on rocky hillsides, flat stone desert, hummocks and vegetated banks along and in drainage valleys.

Remarks: The fact that fusion of the 2nd and 3rd upper labial is part of the individual variation within the range of *T. p. punctatissimus*, is good supporting evidence that these taxa are only subspecifically distinct.

Typhlacontias gracilis Roux (Figs 4b, 7)

Typhlacontias gracilis Roux, 1907. Rev. Suisse Zool. 15: 83, Fig. 3—4 (Type locality: 'Zambezi'. Type in Neuchatel Nat. Hist. Museum). Angel 1920: 617 (Lealui). Pitman 1934: 306. De Witte & Laurent 1943: 35, fig. 54—55. Greer 1970: 14. Broadley 1971: 58. Welch 1982: 79. Branch 1988: 125.
Typhlacontias gracilis gracilis, Broadley 1971: 58.

Material: 113 specimens examined. Type seen.

Etymology: Referring to its gracile or slender body shape.

Diagnosis: Least tendency for head scales to fuse, as a consequence has more than other taxa. Four normal sized lower labials with the fourth slender and horizontal, six upper labials with third entering orbit, prefrontal separated from frontoparietal by third supraorbital (In type antero-upper temporal fused with third supraorbital Fig. 4b). Eye usually in touch with third upper labial, two preoculars, two of three supraoculars and three postoculars.

Description: Large rostral not strongly notched laterally. Dorsal head scalation as typical for this genus with frontonasal slightly larger than internasal and frontal. Narrower frontal allows space for a prefrontal wedged between frontonasal and two supraoculars. Frontoparietal fits into notch between frontal and interparietal. Two supraoculars in touch with eye are followed by a third scale, here referred to as third supraocular, separated from eye by upper postocular, but in touch with the frontal thereby separating frontoparietal and prefrontal. All

other taxa, except *T. rohani*, have two supraoculars of which at least one is in touch with the lateral edge of the frontal. Usually two preoculars and one to three postoculars occur.

Type has anterior upper temporal fused with third supraocular and this enlarged scale touches frontal laterally, thereby separating prefrontal from frontoparietal (Fig. 4b). NMZ 7894 from Kalabo has labial one and two fused, with that enlarged scale on the left side showing a slight dorsal notch. Accordingly only five upper labials exist and "second" enters the orbit. Nevertheless, frontoparietal and interparietal are still separated by third supraocular and two preoculars exist, thereby distinguishing it from Kalabo *T. rohani*. Opinions of what constitutes a labial scale appear to differ. This reviewer considers *T. gracilis* to have six upper labials and usually four lower labials. The fourth lower labial is narrow and horizontal, sometimes only visible when the mouth is opened and it extends to below the sixth upper labial.

Body covered with 18 tight-fitting scale rows. Anal scales not markedly enlarged.

Cleared specimens TM 33866 and TM 33880, both from Kalabo, have 68 and 60 spinal vertebrae, remnants of pectoral and pelvic girdles but no limb rudiments.

Ventrals: Range = 122—147, $\bar{x}$ = 134.66, n = 43, SD = ± 4.74. Subcaud.: Range = 60—65, $\bar{x}$ = 62.5, n = 14, SD = ± 3.88.

Size: Max SVL = 84 mm (NMZ 7875 Kalabo). Max total = 93 (64 + 29) mm (NMZ 6799 Kalabo). Min SVL = 38 mm (NMZ UM 10060 Kalabo). Min total = 79 (53 + 26) mm (NMSR 3406 Kabompo). Rel. tail length: Range = 40—61 %, $\bar{x}$ = 49,34 %, n = 29, SD = ± 4.39.

Colouration: Buff to straw coloured. Each scale is dark centred, with dark spot varying in size and equal sized spots may form lines, s. a. two faint vertebral lines which start in some dark marks on top of the head. A lateral line, which, when well developed, may be dark brown and include the snout, starts in the eye area extending to the tail tip. The intensity of the lined pattern varies extensively.

Range (Fig. 7): Western Zambia, i. e. Barotseland in the upper Zambezi Plains.

Distribution records: ZAMBIA: Kabompo 1324Ca (NMZ); Kalabo 1422Dc (NMZ, TM, ZFMK); Lealui 1523Aa (MHNP, Angel 1920); Lyumba 1430Ca (FMNH, Broadley 1971).

Field notes: Found in high rainfall area in Kalahari sand together with other fossorial skinks s. a. *Typhlosaurus lineatus jappi*, *Lygosoma sundevallii* as well as several amphisbaenian taxa and their snake predators of the genera *Amblyodipsas* and *Xenocalamus*. This taxon occurs in an area with a higher average annual rainfall than any of the other *Typhlacontias* taxa and as a consequence may have to cope with flooding of the Barotse Plains and associated hazards.

Remarks: The re-examination of the long series of specimens from Kalabo provided proof that at that site *T. rohani* occurs sympatrically with *T. gracilis* and therefore these two taxa are here reinstated as full species.

Typhlacontias rohani Angel (Figs 4a, 7)

Typhlacontias rohani Angel, 1923. Miss. Rohan-Chabot Angola-Rhodesia (Paris) 4: 162, figs 6—8. (Type locality: Lwankundu, south-east Angola. Type in Paris Nat. Hist. Museum). Angel 1942: 109. De Witte & Laurent 1943: 35. Welch 1982: 79.

Typhlacontias ngamiensis FitzSimons, 1932. Ann. Transv. Mus. 16: 37 (Type locality: Mothlatlogo = Bothatogo, Botswana. Type in Transvaal Museum, paratype in Field Museum, Chicago), and 1935: 374, figs 17—19, also 1943: 239. De Witte & Laurent 1943: 35. Mertens 1955: 77 and 1971: 71. Broadley 1962: 805. Haacke 1965: 20. Welch 1982: 79. Griffin 1985: map 51.

Typhlacontias gracilis ngamiensis, Broadley & Blake 1979: 7. Branch 1988: 125.

Typhlacontias gracilis rohani, Auerbach 1987: 103. Broadley 1988: 376.

Material: 233 specimens examined. Type seen.

Etymology: Named in honour of M. de Rohan-Chabot who led an expedition in 1914 into the south-eastern part of Angola, an area which is herpetologically still unexplored.

Diagnosis: No enlarged lower labial scales, five upper labials with second entering orbit, frontoparietal and prefrontal in contact with one another.

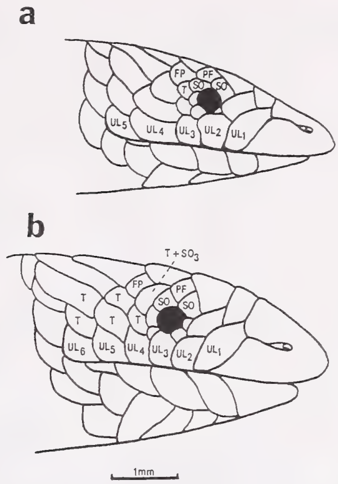

Fig. 4: a) *T. rohani* Angel, holotype MHNR 1923.1.1, Lwankundu River, Angola; b) *T. gracilis* Roux, holotype, unnumbered. Upper Zambezi River, Zambia (For abbreviations see Fig. 5.)

Description: Snout depressed with a horizontal edge. Rostral only as long as the narrow internasal plus the broad fontonasal. Rostral with only slight lateral notches but fairly long nasal sutures enclosing minute postnasals. Five upper labials with the second (2 and 3 fused?) entering the orbit. Usually one or two small preoculars. In the Kalabo series these two scales have fused into a narrow vertically elongate scale separating the loreal from the eye, while in the type the loreal enters orbit above a small preocular (Fig. 4a) and in the type of *T. ngamiensis* no preocular is apparent, as it is often the case in other specimens when the minute scale is covered by the loreal. Frontoparietal and prefrontal in contact, separating the two large supraoculars from contact with frontal, usually two postoculars of which the lower prevents contact between lower anterior temporal and upper labial in contact with eye. Four lower labials of which the last is narrow, horizontally elongate and sometimes invisible unless the mouth is opened. Midbody scale rows 18, four anal scales not significantly different from ventrals.

Ventrals: Range = 124—146, n = 193, $\overline{x}$ = 134.26, SD = ± 4.57. Subcaud.: Range = 64—84, n = 73, $\overline{x}$ = 69.4, SD = ± 11. 3.

Size: Max SVL = 90.0 mm (TM 30971, Tsodilo Hills). Max total = 125 (83 + 42) mm (TM 38347, 50 km W of Tsumkwe). Min SVL = 33.0 mm (TM 39313, nr Katima Molilo). Min total = 50 (33 + 17) mm (TM 39313, nr Katima Molilo). Rel. tail length: Range = 48—73 %, n = 69, $\overline{x}$ = 56.95 %, SD = ± 5.98.

Colouration: Similar to *T. gracilis*, but in some areas, such as the Kwando River in the Caprivi Strip, Namibia, exceptionally dark specimens occur, as the dark centre blotches of each scale are larger and better developed than usual. In these specimens the body sides are dark brown and the head, especially the snout, is also very dark.

Discussion: *T. rohani* and *T. gracilis* are very similar in general characteristics, s. a. size, scalation, colouration, etc. which justifies the idea that they are only subspecifically distinct. However, there are some differences of which the main features are very consistent, nl. the facial scalation. *T. rohani* has a fairly wide geographical range in north-eastern Namibia, northern Botswana, western Zimbabwe and probably south-eastern Angola. Throughout this range the available specimens have five upper labials with the second (2 and 3 fused?) in contact with the orbit. Furthermore the frontoparietal and prefrontal are in contact with one another. In contrast *T. gracilis* has six upper labials and the third enters the orbit while the

frontoparietal and prefrontal are separated by a third supraocular scale. As the main range of *T. gracilis* lies in Barotseland of western Zambia with a collecting gap of about 300 km between Kalabo and the Caprivi Strip of Namibia the subspecies status was probable and difficult to dispute. However, a re-evaluation of a large number of the sample from Kalabo proved that 18 specimens have the characteristics of *T. rohani* from further south with no significant variation in the main features. A local variation of that sample is a slender, upright preocular, separating the loreal from the orbit. A single *T. gracilis* specimen (NMZ 7894) has only five upper labials as the first and second fused. Of these the left one has a slight dorsal notch, indicating that that large scale is indeed a result of fusion. Two preoculars are present and the supraoculars are divided by the upper of the first temporals. This means, although it suggests a relationship with *T. rohani*, it is a *T. gracilis* with a slight aberration. Greer (1970: 14) compared a skull of *T. gracilis* with one of *T. rohani* (= *T. ngamiensis*) and found a difference in the palatal rami between the two taxa. To further test the relationship between *T. rohani* and *T. gracilis*, especially with reference to Kalabo, some statistical tests were carried out. The ventral scale counts vary significantly and show up differences. Furthermore the subcaudal counts and relative tail lengths of *T. rohani* from Kalabo and *T. rohani* from elsewhere, were compared but no difference was found, indicating conspecificity. However, when the data for the Kalabo *T. rohani* were subjected to a T-test in comparison to the data of *T. gracilis*, in both the cases, i.e. subcaudals (sig. level = 5.01784E-4) and tail/body ratio (sig. level = 3.19417E-3) were found to be highly significant, providing additional evidence that two species are involved. As a consequence of proven sympatry of these two taxa at Kalabo, they are accepted as full species of which the ranges overlap in western Zambia.

Range (Fig. 7): Kalahari sand with an average annual rainfall above 400 mm p. a. in NE Namibia including the Caprivi Strip, northern Botswana, western Zimbabwe, SE Angola and western Zambia as far as the Zambezi Valley.

Distribution records: ANGOLA: Lwankundu River 1620Ad (MHNP); BOTSWANA: Bothatogo 2022Db (TM, FMNH); Dibejama 1821Ad (FMNH); Dodo Crossroads 1825Cb (NMZ); near Gubatsha Hills 1824Ca (TM); Kasane 1725Cc, Maun 1923Cd, Ngwezumba Bridge 1824Bd (NMZ); Savuti Camp 1823Db, Shakawe 1821Bd (TM); Tamafupi 1926Ac (NMZ); Tsoe 2024Cb (LACM); Tsodilo Hills 1821Db (TM). NAMIBIA: near Grootfontein 1919Bc (TM); Kanovlei 1919Ab (SMW); Katima Mulilo 1724Cb (TM); 15 km and 65 km WSW of Katima Mulilo 1724Ca (NMZ, TM); Kwando River 1723Cd (TM); Kwetche (Mahango Reserve) 1821Ba, Leeupan 1820Bd, 10 km S of Leeupan 1820Db (SMW); Makambu 1718Ad, Mangetti Forest 1818Da (TM); Mpungu 1718Ca (SMW); Odila Dam 1716Bd (TM); Rundu 1719Dd (TM, SMW); Samangeigei 1920Aa (TM); 25 km NW of Tamsu 1820Ba; Tsumkwe 1920Da (SMW); 50 km W of Tsumkwe 1920Ac, 55 km NW of Tsumkwe 1920Aa, Verskyn 1919Aa, Wenela 1723Cb (TM); Western Veterinary Fence 2120Ac (SMW). ZAMBIA: Kalabo 1422Dc (NMZ 6766-7, 6769, 6780, 6782, 6787, 6791, 6793, 6795, 7894, 10048, 10050, 10052-4, TM 33868, 33887, 35580). ZIMBABWE: Bembesi Vlei 1826Dc (NMZ); 10 km NW of St. Martin's Mission 1927Bb (TM); Dahlia 1827Ca, Dandari 1826Cc, Dett 1826Db, Dina Pan 1826Cd, 6 km S of Dina Pan 1926Ab, Dopi Windmill 1826 Dd, Good Luck Ranch 1827Ca, Gubalala 1826Dc, Kennedy 1827Cc, Lupane 1827Dd (NMZ); Main Camp, Hwange 1826Db (TM); Manzimbomvu Pan 1826Cc, Maraposa, Nyamandlovu 1928Cc, Shapi Pan 1826Dc, Somavundhla Pan 1927Aa, Teaklands 1927Bd, Tibukai Pan 1825Dd, Verney's Pan 1826Dd, Victoria Falls 1725Dd, Westwood Ranch 1725Dd (NMZ).

Field notes: Active sandswimmers which forage just below the sand surface at night, leaving thin, regularly undulating tracks. As more vegetated environment is utilised these tracks are not as obvious as those occurring in desert sand. May be found by raking in leaf litter under bushes and elsewhere or by turning over logs, as no stones occur. Feeding on small insects s. a. beetle larvae and termites. Biological information is limited. Appears to be ovoviviparous as a specimen from 15 km W of Katima Molilo (NMZ-UM 22889) contains three full term young. However, a specimen from Kalabo (NMZ-UM 6766) is gravid with four large eggs (each about 3.5 x 5.5 mm) which show no sign of development. Unfortunately no collecting dates exist which would allow deductions relating to the season. Other sandswimmers which share the range are *Typhlosaurus lineatus lineatus* in Namibia and Botswana and *T. l. jappi* in western

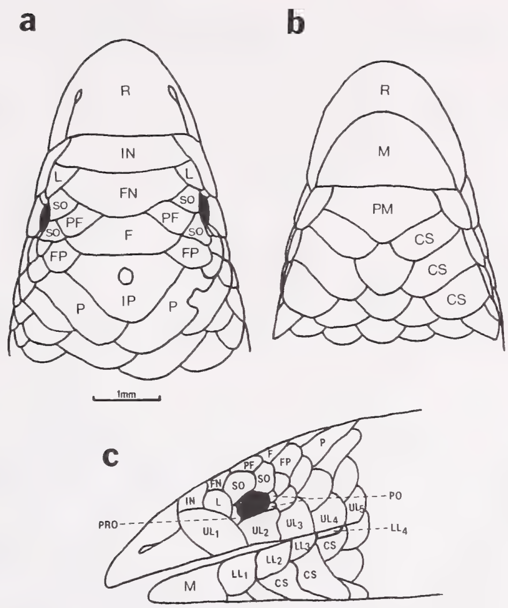

Fig. 5: *Typhlacontias rudebecki* sp. n., holotype TM 25465, São Nicolau, Angola; a) dorsal, b) ventral, c) lateral view. CS = chin shield, F = frontal, FN = frontonasal, FP = frontoparietal, IN = internasal, IP = interparietal, L = loreal, LL = lower labial, M = mental, P = parietal, F = prefrontal, PM = postmental, PO = postocular, PRO = preocular, R = rostral, SO = supraocular, T = temporal, UL = upper labial.

Zambia. Several amphisbaenians also share this moist environment s. a. *Zygaspis quadrifrons*, *Monopeltis anchietae*, *M. leonhardi*, *M. sphenorhynchus*, *Dalophia pistillum* and *D. longicauda*. Several burrowing snakes are specialised predators of these sandswimmers and will also consume *Typhlacontias rohani* and *T. gracilis*. The most probable predators are *Amblyodipsas ventrimaculata*, *Xenocalamus mechowii* and *X. bicolor*.

Typhlacontias rudebecki sp. n. (Figs 5a, b, c, 7).

Etymology: Named after the collector Dr G. Rudebeck, who was a member of the Swedish Lund University Expedition to South Africa at that time.

Holotype: TM 25465, sex undetermined, collected during September 1956 by G. Rudebeck.

Type locality: São Nicolau, Moçâmedes (= Namibé) district, Angola (1412 Ad).

Diagnosis: Lower labials not fused, number of ventrals higher than of related *T. gracilis*. Rostral not notched laterally, five upper labials with first (= fused 1 and 2?) very large, extending to below anterior edge of eye, loreal separated from second upper labial which is in touch with the eye.

Description: TM 25465, Holotype. Tail incomplete and body cut into two parts, 49 mm and 33 mm long with a total of about 152 ventrals and 18 scale rows around the body. Rostral laterally not notched and subequal in length to first three azygus scales on the top of the head i. e. internasal, frontonasal and frontal (Fig. 5a). Nostrils, followed by tiny oblong nasal scale, pierced in sides of rostral with short straight suture connecting them to back edge. Eye round, exposed but with slight overlap by second upper labial and supraoculars. First upper labial

Fig. 6: Distribution of *Typhlacontias brevipes* in the Namib Desert.

large (1 & 2 fused?), anteriorly extending to above level of eye and posteriorly past anterior edge of the eye. Loreal separated from eye and second upper labial by single preocular. Five upper labials of which second is in broad contact with eye, two small postoculars, two large supraoculars in touch with prefrontal, posterior supraocular in touch with frontal, thereby separating similar-sized prefrontal and frontoparietal. Pineal eye clearly visible in the relatively small subpentagonal interparietal. Frontonasal larger than internasal or frontal. The large mental is followed by a large postmental (Fig. 5b), four lower labials of which the narrow horizontal fourth scale is difficult to see when the mouth is closed.

Colour: Dorsum pale with a light brown vertebral stripe two half scales wide, bordered by a dark lateral line three scales wide which extends forward through the eye to the nostril. Ventrally each scale of four rows bears a light brown spot.

Discussion: According to the unfused lower labials this taxon is closer to *T. rohani* and *T. gracilis*, than to the Namib species. However, the general proportions differ and the habitat, although not specifically recorded, is coastal Namib Desert. *T. gracilis* and *T. rohani* are restricted to Kalahari sand at a fairly high altitude with a fairly high average annual rainfall.

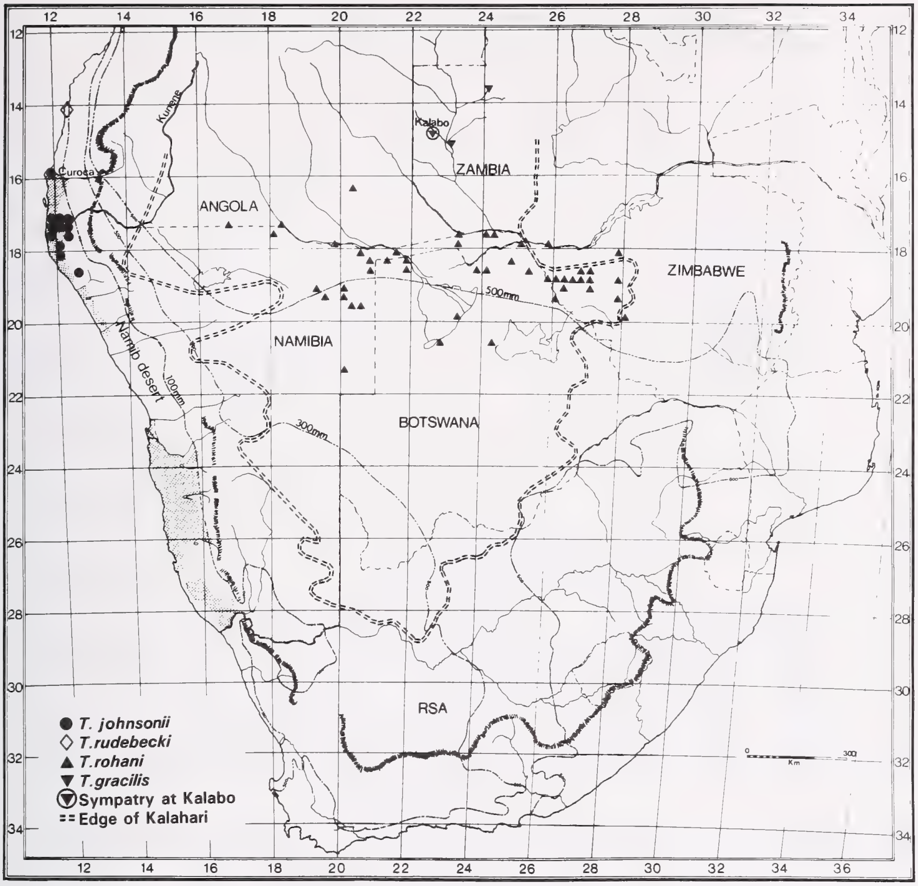

Fig. 7: Distribution of *T. johnsonii* and *T. rudebecki* sp. n. in the northern Namib Desert and *T. rohani* and *T. gracilis* in the northern Kalahari sands.

Discussion

Character analysis: Greer (1970: 14) gave a description of the general characteristics of the genus. He discussed the skull of *T. brevipes*, *T. gracilis* and *T. rohani* (= *T. ngamiensis*) and their general external characters. His identification of head-scales differs from that of this author. The supraoculars of Greer, in touch with the sides of the interparietal, are here considered to be frontoparietals as these scales do not reach the eye, but are in touch with frontal and interparietal in all species and usually the parietals as well. The extra scale wedged laterally between frontal and frontonasal and two supraoculars are here referred to as prefrontals. Scales in contact with the dorsal aspect of the eye are referred to as supraoculars, as was done when describing *T. brevipes* (FitzSimons 1939: 15). Greer (op. cit.) interprets the presence of a large interparietal and a single transverse internasal (postrostral) as an indica-

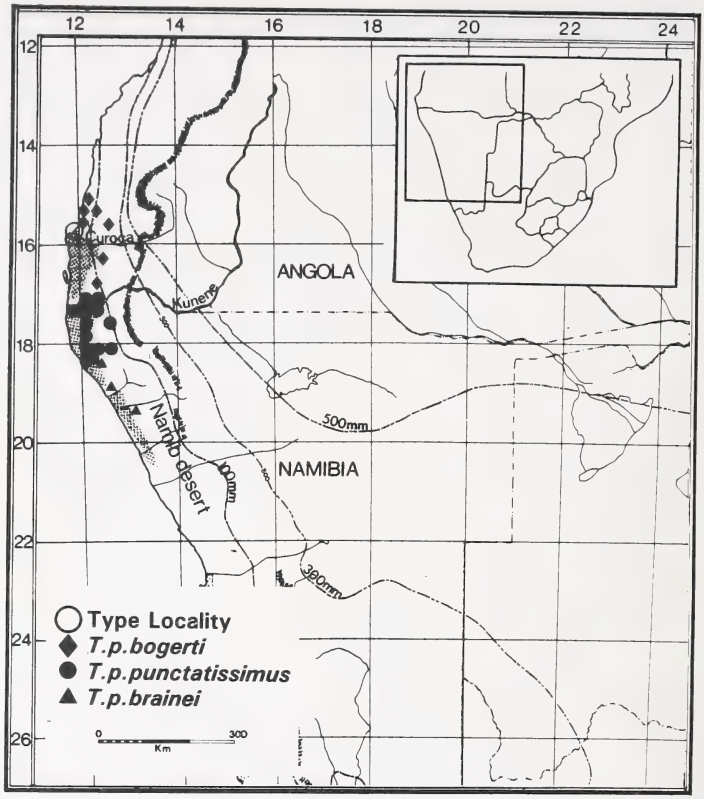

Fig. 8: Distribution of the three subspecies of *Typhlacontias punctatissimus* in the northern Namib Desert.

tion of a relationship with *Scelotes* and he assumes that *Typhlacontias* evolved in arid areas of southern Africa, with *T. brevipes*, due to the presence of external limb rudiments and a relatively large postnasal scale, as the most primitive form. In the light of Broadley's (1968) evaluation of evolutionary trends in the acontine scincid genus *Typhlosaurus*, one may have to re-evaluate Greer's suggestion. A number of morphological characters of the eight taxa are listed in Tables 1 and 2. The presence or absence of the very large second (= fused second and third?) lower labial in combination with the presence of prefrontals separates this genus into two groups.

T. brevipes, *T. johnsonii* and *T. punctatissimus*, have this large second lower labial, but no prefrontal and are Namib Desert endemics (Figs 6, 7, 8), while *T. gracilis*, *T. rohani* and *T. rudebecki* sp. n. have no fused lower labials but a prefrontal above the supraoculars. The first two species of the latter group are widespread in Kalahari sand with high rainfall at fairly high altitude above sea level (Fig. 7). In contrast the presence of *T. rudebecki*, of which the range is still unknown, on the northern Namib coast at sea level is not yet understood.

Broadley (1968: 18) lists three trends in *Typhlosaurus* Wiegmann (Acontinae), which imply degrees of evolutionary advancement or a greater degree of specialisa-

tion to a fossorial lifestyle. These might be applicable to *Typhlacontias* as well, nl. a) a reduction in the number of headshields, b) progressive attenuation of the body, and c) simultaneous increase in the number of ventrals. The latter trend in fossorial lizards is usually correlated with a reduction in tail length. All these changes are obviously related to greater specialisation as sand swimmers. Applying these parameters, *T. gracilis* with the most numerous headshields and long tail has retained with *T. rohani* a number of primitive characters, although the latter has started to reduce its tail length. *T. rudebecki* might rate as the most specialised or advanced in this group due to the amount of head scale reduction and the apparent attenuation of the severed body. Although primitive characters persist, limb loss (one cleared *T. gracilis* and three *T. rohani* checked), an advanced feature, is complete.

The Namib Desert endemics with the enlarged second lower labials, i.e. *T. brevipes*, *T. punctatissimus* and *T. johnsonii* show a similarly involved picture. *T. brevipes* with its externally visible limb rudiments and enlarged postnasal, which supposedly are retained ancestral characters, is the most primitive species in the eyes of Greer (1970: 15). However, some features appear to be specialised or advanced, such as the high number of ventrals, a relatively short tail and a wedge-shaped head with a reduced number of head scales. *T. punctatissimus* has retained a gracile body shape and a long tail similar to *T. gracilis* and *T. rohani* but, although it has a reduced number of head scales, internally it may still have minute femur and occasionally even externally visible limb rudiments. Within the three subspecies of this species small variations in the reduction of head scales exist.

T. johnsonii, with its high number of ventral scales, the relatively shortest tail, the most depressed wedge-shaped head and with the greatest reduction of head scales, is according to these criteria the most specialised or advanced taxon of this group and the genus.

To test these deliberations a data matrix for 14 characters was generated for the 8 recognised taxa with *Sclotes brevipes* as an outgroup (Tables 3 & 4). The phylogenetic systematics computer program Henning86, version 1.5 (Farris 1988), was used to generate a phylogenetic hypothesis, expressed as a cladogram.

```
        ╔═ 0 Scelotes bipes
├ 14 ═══╣      ╔═ 1 T.brevipes                    ┐
        ╠═ 12 ═╩═ 2 T.johnsonii                   │
        ║      ╔═ 4 T.p.punctatissimus            ├ Namib
        ╚═ 13 ═╣      ╔═ 3 T.p.bogerti            │
               ╚═ 11 ═╬═ 5 T.p.brainei            ┘
                      ║      ╔═ 7 T.rohani        ┐
                      ╚═ 10 ═╣      ╔═ 6 T.gracilis ┘ - Kalahari
                             ╚═ 9 ══╩═ 8 T.rudebecki ] - Namib
```

Table 3: Data list for *Typhlacontias* taxa and *Scelotes bipes* as outgroup.

1.	Tail/SVL %	>50 % = 0, <50 % = 1, <40 % = 2, >30 % = 3.
2.	Max SVL	<100 mm = 0, >100 mm = 1.
3.	Ventrals	<125 = 0, <135 = 1, <145 = 2, >145 = 3.
4.	Vertebrae	60−65 = 0, 65−70 = 1, 70−75 = 2, >75 = 3.
5.	Enl.llab2	Absent = 0, present = 1.
6.	Upl./eye	3 = 0, 2 = 1, 2 &/or 3 = 2.
7.	Lor./upl.2	Contact = 0, no cont. = 1.
8.	Supraocul.	3 = 0, 2 = 1, 1 = 2.
9.	Hind limb	Ext. = 0, ext/int. = 1, absent = 2.
10.	Prefrontal	Present = 0, absent = 1.
11.	Rostr. sut.	Shrt & pstn = 0, lng & pstn = 1, no pstn = 2.
12.	Supoc/frnt.	3 = 0, 2 = 1, 0 = 2, 1&2 = 3, 1 = 4.
13.	Supoc/eye	2 = 0, 1 = 1, 0 = 2.
14.	Eye lid	Present = 0, absent = 1.

Table 4: Data matrix for eight *Typhlacontias* taxa and *Scelotes bipes* as outgroup.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
T. brevipes	2	1	2	1	1	0	0	1	2	0	0	3	0	0
T. johnsonii	3	1	2	2	1	1	0	2	0	2	0	4	1	0
T. p. bogerti	0	0	0	0	1	2	0	1	1	1	1	3	1	0
T. p. punctat.	0	0	0	0	1	0	0	1	1	1	1	3	1	0
T. p. brainei	0	0	0	9	1	1	0	1	1	1	1	3	1	0
T. gracilis	0	0	1	1	0	0	0	0	0	2	1	0	0	0
T. rohani	0	0	1	0	0	1	1	1	0	2	1	2	0	0
T. rudebecki	9	0	3	9	0	1	0	1	9	2	1	1	0	0
Scel. bipes	3	0	0	0	0	0	0	0	2	0	0	3	2	1

A single tree (Length 30 steps, consistency index 0.67, retention index 0.62) was generated, confirming the basic clustering as viewed by the author.

T. brevipes, *T. johnsonii* and *T. puntatissimus* of the Namib Desert with the enlarged second lower labial, no prefrontal scales and leg rudiments in two taxa form the more ancestral group. *T. gracilis*, *T. rohani* from Kalahari sand and *T. rudebecki*, from the Namib coast, with normal-shaped lower labials, prefrontal scales, slender long-tailed bodies and no indication of limb rudiments, form an apparently more advanced group. In this context the status of *T. rudebecki* is slightly compromised, as that single tailless specimen could not be cleared, reducing its data content by three.

In addition the same data matrix was run using PAUP version 3.1.2d5 (Swofford 1985). PAUP generated two most parsimonious trees, 56 steps in length with a consistency index of 0.46. The measure of phylogenetic content in the data set as measured by the g1-statistic (=0.36) showed a significant phylogenetic signal. A strict consensus analysis of these two trees produced an unresolved trichotomy between *T. brevipes*, *T. johnsonii* and *T. rudebecki*. This situation lacks credibility and is probably due to the fact that the type specimen contributed three less data points to the matrix. A bootstrap analysis of the two trees indicated a 100 % frequency in all internal branches.

It seems essential to increase the data set for a thorough phylogenetic analysis, which is only possible once more material, in particular of *T. rudebecki*, becomes

available. Until such time the Hennig86 must serve as a preliminary hypothesis of phylogenetic relationships.

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Zusammenfassung

Typhlacontias ist eine der zahlreichen, sandwühlenden Skinkgattungen mit degenerierten Gliedmaßen. Die Verbreitung der sechs bekannten Arten ist auf die Namib-Wüste und das zentrale Kalahari-Becken des südlichen Afrikas begrenzt. Die Gattung wurde an Hand von zwei schlecht konservierten Exemplaren von Bocage (1873) beschrieben, so daß der Autor 1895 nach Erhalt eines dritten Exemplares von der Terra typica die Art nachbeschrieb. Letzteres Exemplar repräsentierte jedoch eine unbeschriebene Art, dazu mit abnormaler Beschuppung, wodurch die Art *T. punctatissimus* unidentifizierbar wurde. Die drei Exemplare wurden bei einem Brand zerstört. Als Andersson sieben weitere Exemplare vom selben Fundort bekam, erkannte er das Problem, revalidierte 1916 die Originalbeschreibung und beschrieb die Art *T. johnsonii* neu. Das einzige Exemplar in dieser Serie, das zu *T. punctatissimus* gestellt werden konnte, hatte sichtbare Beinrudimente, die bisher nur bei einem weiteren Exemplar der Art festgestellt werden konnten, weshalb es nicht als Neotypus geeignet ist. Anderssons Arbeit wurde leider bis jetzt völlig übersehen. Inzwischen wurde sehr viel neues Material gesammelt und neue Arten beschrieben, die aber erst nach dem Wiederauffinden von Anderssons (1916) Arbeit zugeordnet werden konnten. In der vorliegenden Arbeit werden dazu eine neue Art und Unterart beschrieben, die Verbreitung aller acht Taxa dokumentiert und ein Versuch gemacht, die verwandtschaftlichen Beziehungen in dieser Gattung zu verstehen.

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Advertisement call characteristics of a Taiwanese green treefrog *Rhacophorus prasinatus*

Masafumi Matsui, Szu-Lung Chen & Kuang-Yang Lue

Abstract. Variations in parameters of three types of notes were analyzed in Taiwanese treefrog, *Rhacophorus prasinatus*. In contrast to the previous knowledge, the type B notes are shown to be well pulsed. Frequency parameters show variation, and are not correlated to temperature. Note duration is predicted to be shortened, and note repetition rate to increase under higher temperatures. From the advertisement call characteristics, *R. prasinatus* is supposed to bridge the gap between *R. viridis* on the one hand, and *R. owstoni* on *R. moltrechti* on the other.

Key words. Vocal repertoire, advertisement call, temperature.

Introduction

Among green treefrogs occurring in Taiwan, *Rhacophorus prasinatus* (Mou, Risch & Lue 1983) is peculiarly big-growing (mean SVL 56 mm in males and 72 mm in females: Chen 1992) as compared with its relatives, and looks very attractive, being emerald green and golden in the body colour. This species has a complicate nomenclatural history, and is better known by its synonym *R. smaragdinus* (Lue & Mou 1983; see Zhao & Adler 1993: 158 for a taxonomic review). Its distribution range is restricted to a limited area of northern Taiwan (Lue et al. 1991). Call characteristics of this species recorded at 27—29 °C have been reported by Chou (1992). As is well known, however, some of the acoustic parameters of anurans vary with changes of the surrounding temperatures (e. g., Nevo & Schneider 1976, Schneider 1977, Zweifel 1968). *Rhacophorus prasinatus* is a prolonged breeder and the temperatures surrounding calling males vary greatly from about 13 to 29 °C (Chen 1992). Thus, Chou's (1992) recordings were made at extremely high temperatures, and additional information is needed to better understand the call characteristics of this species. In this article, we will report on the acoustic characteristics of *R. prasinatus* recorded at temperatures lower than those reported by Chou (1992), and clarify the more detailed structure of some calls. Also, relationships of temperature to call parameters are analyzed in this species.

Materials and methods

Calls of *R. prasinatus* were recorded at Mt. Tatung Shan, Feitsui valley, Taipei Hsien on 12, 14, and 24 December 1991. All calls were recorded in the field with cassette tape recorders (Sony TCD5 & TCD5M) with external microphones (Sony ECM-23F & Audio-technica ATM 53) and analyzed using computer programs, SoundEdit Vers. 2 or SoundEdit Pro (MacroMind-Paracomp, Inc.) by a Macintosh computer. Air temperatures recorded near the calling males, were 18.2 °C, 15.0 °C, and 19.0 °C, on 12, 14, and 24 December 1991, respectively.

In the following description, the term "note" means a pulse group, "note length" the time from the beginning of the first pulse to the end of the last pulse in a note, and "pulse repetition

rate" the number of pulses per s. Sample size (n) is indicated as the number of calls or notes analyzed/the number of males recorded, and means are given for the number of calls recorded. For statistic analyses, Wilcoxon rank sum tests were utilized. In order to examine relationships between parameters, analysis-of-covariance (ANCOVA) was performed. The significance level was set at 0.05.

Results

From the field observation of breeding behavior, advertisement, courtship, encounter, release, and distress calls (Duellman & Trueb 1986) were differentiated in the vocal repertoire of male *R. prasinatus* (Chen 1992). Of these, the advertisement call included three types of notes (fig. 1), which assuredly correspond to the types, A, B, and C, of Chou (1992). In the following descriptions, only these three note types are considered.

We could not record type B and C notes at 15.0 °C. In the type A note, some of the temporal and frequency characteristics differed between calls recorded at different temperatures, but differences were insignificant between calls recorded at 18.2 °C and 19.0 °C. Thus, the following descriptions and comparisons are made mainly on calls recorded at 15.0 °C and 18.2 °C.

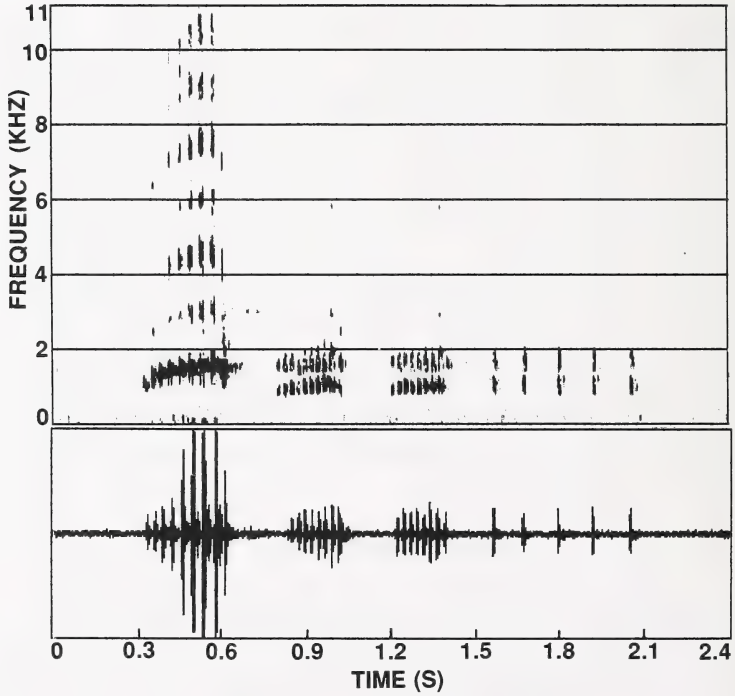

Fig. 1: A sonagram (top) and a sound wave form (bottom) of an advertisement call of *Rhacophorus prasinatus*, including one type A, two type B, and four type C notes. Recorded at 18.2 °C.

The type A note (fig. 2) was well pulsed and included five to 15 pulses (table 1). The note length increased with increasing number of pulses, and at 15.0 °C, the mean length varied from 0.302 s in the note with seven pulses to 0.613 s in the note with 15 pulses. The pulse repetition rate was almost constant, means varying from 23.04 to 24.70. Each pulse, except for the initial and the final one, had clear harmonics, and a clear frequency modulation was seen within a note (fig. 1). The dominant frequency in the mean of the initial pulse was about 1135—1400 Hz, but it increased to about 1500—1600 Hz in the mean of the climax pulse, and rapidly decreased to about 1100—1300 Hz in the final pulse. In the climax pulse, the second dominant frequency was about 4400—4750 Hz, and seven harmonic bands in total were apparent between 0—11 000 Hz (fig. 2). Average harmonic interval, therefore, was about 1550 Hz, and this value corresponded to the fundamental frequency. Thus, the first dominant frequency was the fundamental and the second corresponded to the third harmonic of the spectrogram.

Similar trends were found in the calls recorded at 18 °C, but the note lengths were significantly shorter than in 15.0 °C (table 1; Wilcoxon rank sum tests: $p<0.0001$ in the eight pulsed note; $p<0.0001$ in the nine pulsed note; $p<0.0003$ in the ten pulsed note). The mean note lengths varied from 0.180 s in the note with five pulsed to 0.395 s in the note with 11 pulses. The pulse repetition rates varied from 27.39 to 32.57, and were much larger than in 15.0 °C (Wilcoxon rank sum tests; $p<0.0001$ in the

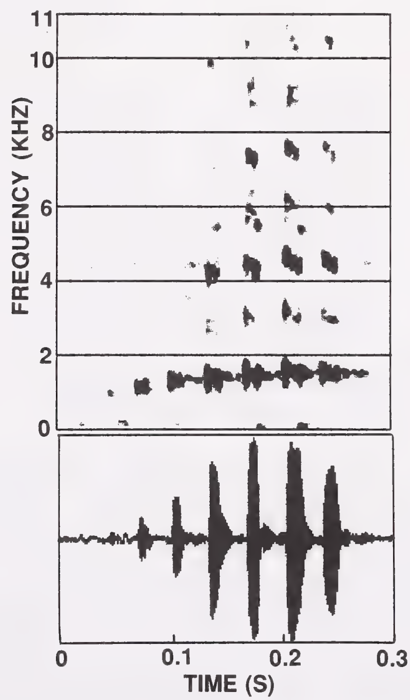

Fig. 2: A sonagram (top) and a sound wave form (bottom) of a type A note of *Rhacophorus prasinatus*. Recorded at 18.2 °C.

Table 1: Characteristics of type A note of *Rhacophorus prasinatus* recorded at 15.0 and 18.2 °C (Mean±1SD, followed by sample size (number of notes/number of males)).

N of pulse	Note length (s)	Pulse repetition rate	Dominant frequency in climax pulse (Hz)
15.0 °C			
7	0.302±0.020 3/2	23.24±1.56 3/2	1500.0±70.7 3/2
8	0.348±0.010 7/4	23.04±0.66 7/4	1557.1±34.5 7/4
9	0.383±0.015 13/5	23.43±0.86 13/5	1584.6±37.6 13/5
10	0.425±0.013 8/4	23.55±0.70 8/4	1556.3±49.6 8/4
11	0.446 2/1	24.70 2/1	1525.0 2/1
13	0.562 2/1	23.13 2/1	1575.0 2/1
14	0.598 1/1	23.40 1/1	1600.0 1/1
15	0.613 1/1	24.49 1/1	1500.0 1/1
18.2 °C			
5	0.180±0.004 3/3	27.82±0.58 3/3	1340.0±52.9 3/3
6	0.219±0.007 8/5	27.39±0.94 8/5	1325.7±64.8 7/5
7	0.235±0.028 16/7	30.38±4.96 16/7	1420.0±154.3 16/7
8	0.273±0.031 26/13	29.86±4.57 26/13	1481.3±95.7 23/13
9	0.314±0.043 16/11	29.38±5.29 16/11	1522.5±63.0 12/11
10	0.332±0.086 12/8	32.57±10.16 12/8	1486.7±51.9 12/8
11	0.395±0.040 9/6	28.11±3.08 9/6	1508.9±27.1 9/6

eight pulsed note; $p<0.0001$ in the nine pulsed note; $p<0.0003$ in the ten pulsed note). Some notes had much larger rates than in others, and these rapid notes were emitted by one individual immediately after another's advertisement call. The mean dominant frequency increased from 938−1027 Hz in the initial pulse to 1325−1522 Hz in the climax pulse, and decreased finally to about 1210−1436 Hz. The dominant frequencies in the climax pulses were significantly lower in calls recorded at 18.2 °C than in 15.0 °C (Wilcoxon rank sum tests: $p=0.019$ in the eight pulsed note; $p=0.005$ in the nine pulsed note; $p=0.020$ in the ten pulsed note).

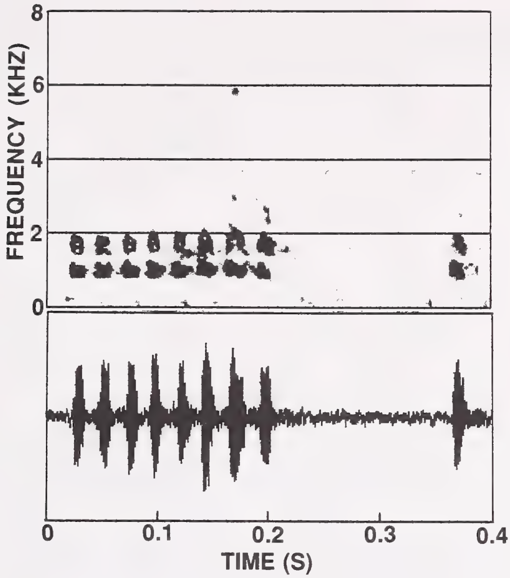

Fig. 3: A sonagram (top) and a sound wave form (bottom) of a part of an advertisement call of *Rhacophorus prasinatus*, showing a type B (eight-pulsed) and a type C notes. Recorded at 18.2 °C.

The type B note (recorded at 18.2 °C) was also pulsed (fig. 3), and the note length varied from 0.014 s in the note with one pulse to 0.340 s in the note with 14 pulses (table 2). When pairs of notes with the same number of pulses were compared, note lengths in the type A notes were always longer than in the type B (Wilcoxon rank sum tests: $p<0.03$), in all the combinations except for the notes with ten pulses. The pulse repetition rate varied from 32.83 to 53.48, but in most cases larger than 40. Some notes with a small pulse repetition rate included pulses with irregular intervals. Like in the note length, the type A notes had larger rates than the type B in all the combinations except for the one with ten pulses (Wilcoxon rank sum tests: $p<0.03$). The dominant frequency varied from about 950 to 1100 Hz, and was much lower than in the type A note (Wilcoxon rank sum tests: $p<0.002$, in all the combinations).

In the type C note (recorded at 18.2 °C), the note length varied from 0.004 s in the note with one pulse to 1.170 s in the note with ten pulses (table 3). The mean pulse repetition rate decreased from 19.31 to 8.54 with the increment of the pulse number. The dominant frequency was similar to that in the type B (fig. 3), and varied from about 950 to 1200 Hz.

As seen in fig. 4, the note duration and the pulse number had positive correlations in all the three note types. Both slopes and positions (table 4) differed among the regression lines (ANCOVA, $p<0.0001$), and from the multiple comparisons among slopes, it was concluded that the slope decreased in the order of type B, type A (15 °C), type A (18.2 °C) and type C. In the type A notes, the calculated slope was

Table 2: Characteristics of type B note of *Rhacophorus prasinatus* recorded at 18.2 °C (Mean±1SD, followed by sample size (number of notes/number of males)).

N of pulse	Note length (s)	Pulse repetition rate	Dominant frequency (Hz)
1	0.014	—	1050
	2/1	—	2/1
2	0.037	53.48	950
	1/1	1/1	1/1
3	0.069±0.006	43.95±4.07	1025.0±50.0
	4/2	4/2	4/2
4	0.085	47.17	1300
	1/1	1/1	1/1
5	0.124±0.012	40.51±3.82	1026.7±40.4
	3/3	3/3	3/3
6	0.189±0.035	32.83±7.23	1004.3±36.0
	7/4	7/4	7/4
7	0.167±0.024	42.47±4.69	1041.0±71.9
	10/5	10/5	10/5
8	0.202±0.037	40.76±6.42	1060.0±63.2
	16/7	16/7	15/7
9	0.224±0.022	40.47±3.84	1073.1±105.3
	15/5	15/5	14/5
10	0.239±0.019	42.16±3.10	1031.1±28.9
	12/9	12/9	9/9
11	0.258±0.008	42.65±1.29	1058.3±49.2
	8/5	8/5	6/5
13	0.317±0.019	41.07±2.47	1100.0±180.3
	3/1	3/1	3/1
14	0.340±0.028	41.38±3.33	1033.3±57.7
	3/1	3/1	3/1

smaller in 18.2 °C than 15 °C, but the position of the regression line was higher in the former, indicating larger pulse repetition rate.

Discussion

Acoustic features of *R. prasinatus* reported here are basically identical to those reported by Chou (1992 as *R. smaragdinus*), but there is at least one great discordance. Chou (1992) reported the note type B to be nonpulsed, but actually it is pulsed as clearly seen in fig. 1. This difference seems to have derived from the difference in the quality of the recording or method of analyses.

As shown in the result, call parameters vary in response to variant temperatures, and this becomes more evident when the present data are compared with those given by Chou (1992). Since Chou (1992) did not give relationships between the number of pulse and other parameters, it is impossible to compare his data directly with ours. However, from his data of pulse repetition rate, some parameters in notes with nine and 11 pulses can be estimated. When these data are considered, it is clear that the

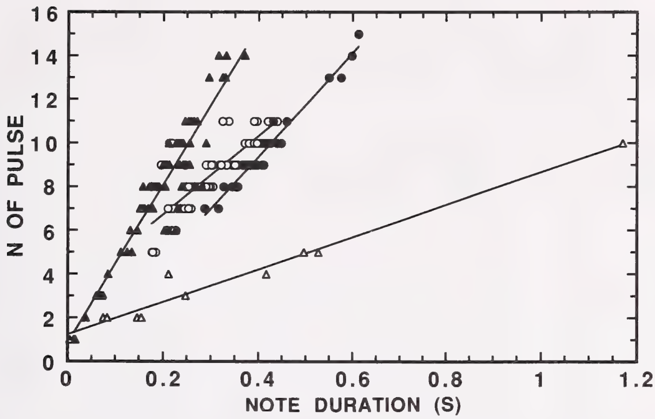

Fig. 4: The relationship between the note duration (in s) and the number of pulse in the three types of notes of *Rhacophorus prasinatus*. Closed circle=note type A at 15.0 °C ($Y=23.834X-0.152$, $r=0.981$, $n=36$ notes/5 males, $p<0.0001$); open circle=note type A at 18.2 °C ($Y=17.932X+3.158$, $r=0.780$, $n=89$ notes/13 males, $p<0.0001$); closed triangle=note type B ($Y=36.284X+0.846$, $r=0.922$, $n=85$ notes/9 males, $p<0.0001$); open triangle=note type C ($Y=7.434X+1.249$, $r=0.984$, $n=11$ notes/8 males, $p<0.0001$).

note decreases in its duration with the increase of the temperature (fig. 5). The relationships of duration (Y) to temperature (X) are expressed as $Y=0.0136X+0.577$ ($r=-0.990$, $p=0.009$) and $Y=-0.0160X+0.688$ ($r=-0.999$, $p=0.005$) in the notes with nine and 11 pulses, respectively. The regression line for the 11 pulsed note is significantly higher in position than that for the nine pulsed one (ANCOVA:

Table 2: Characteristics of type C note of *Rhacophorus prasinatus* recorded at 18.2 °C (Mean±1SD, followed by sample size (number of notes/number of males)).

N of pulse	Note length (s)	Pulse repetition rate	Dominant frequency (Hz)
1	0.004	—	1200
	1/1	—	1/1
2	0.115±0.042	19.31±7.08	1100.0±204.1
	4/2	4/2	4/2
3	0.247	12.13	1000
	1/1	1/1	1/1
4	0.314	14.26	950
	2/2	2/2	2/2
5	0.511	9.79	1050
	2/1	2/1	2/1
10	1.170	8.54	1100
	1/1	1/1	1/1

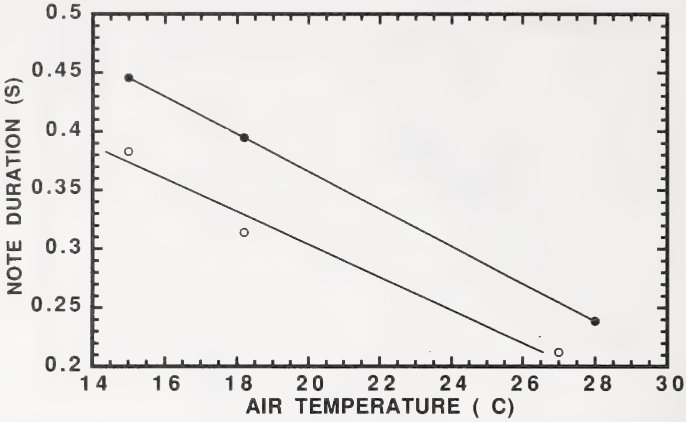

Fig. 5: The relationship between the air temperature (°C) and the note duration (in s) in the type A notes of *Rhacophorus prasinatus*. Data for 27 °C and 28 °C calculated from Chou (1992). Closed circle = note with 11 pulses ($Y = -0.016X + 0.688$, $r = -0.999$, $n = 3$, $p = 0.005$); open circle = note with nine pulses ($Y = -0.014X + 0.577$, $r = -0.990$, $n = 4$, $p = 0.009$).

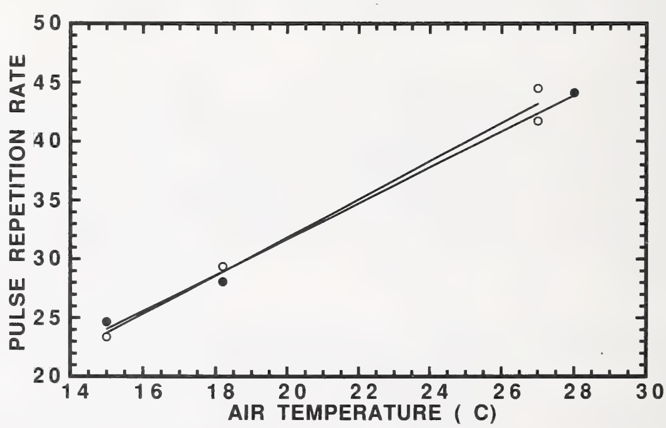

Fig. 6: The relationship between the air temperature (°C) and the pulse repetition rate in the type A notes of *Rhacophorus prasinatus*. Data for 27 °C and 28 °C calculated from Chou (1992). Closed circle = note with 11 pulses ($Y = 1.529X + 1.116$, $r = 0.997$, $n = 3$, $p = 0.047$); open circle = note with nine pulses ($Y = 1.622X - 0.581$, $r = 0.993$, $n = 4$, $p = 0.007$).

$p = 0.005$), though the slopes did not differ between the two lines (ANCOVA: $p > 0.05$).

Pulse repetition rate also correlates to the temperature, and the number of pulse per unit time is predicted to increase under higher temperature conditions (fig. 6). The relationships of repetition rate (Y) to temperature (X) in the notes with nine and 11 pulses are expressed as $Y = 1.6216X - 0.581$ ($r = 0.993$, $p = 0.007$) and $Y = 1.5294X + 1.116$ ($r = 0.997$, $p = 0.047$), respectively. Unlike in the note duration, neither the slope nor position differed in the two regression lines (ANCOVA:

$p>0.05$), and the combined regression line is expressed as $Y=1.5831X+0.156$ ($r=0.994$, $p<0.0001$). In contrast to these two parameters, frequency parameters (initial, climax, and final ones) are insignificantly correlated to the temperature (ANCOVA: $p>0.05$).

Because of the presence of three different note types, Chou (1992) considered the call of *R. prasinatus* complicated and unique among the rhacophorid frogs of Taiwan, Ryukyu Is., and Japan. However, Chou (1992) himself noted that other Taiwanese species, *R. taipeianus* and *R. moltrechti* also had at least two types of calls. In fact, the vocal repertoire of *R. prasinatus* is not limited to these three types (Chen 1992), and an even more complicated repertoire is found in *R. arboreus* from Japan (Kasuya et al. 1992). Thus, the 'complicated calls' are not unique to *R. prasinatus* among the rhacophorid frogs of these regions.

Chou (1992) emphasized the complexity of the call in *R. prasinatus* and associated this species with *R. appendiculatus* and *R. bimaculatus* (=*R. bipunctatus*) from Thailand, both of which have been reported to have complicated calls (Heyer 1971). Actually, call structures of the latter two species are quite dissimilar to those of *R. prasinatus*, so are their morphologies (Matsui unpublished), and acoustic convergences or close phylogenetic relationships in these species are unlikely.

Instead, *R. prasinatus*seems acoustically related to species from Taiwan and Japan. On the basis of acoustic characteristics, Kuramoto & Utsunomiya (1981) suggested the possibility of splitting species of *Rhacophorus* known from Japan and Taiwan at that time into three groups: 1) *R. taipeianus*, 2) *R. moltrechti* and *R. owstonii*, and 3) *R. arboreus*, *R. schlegelii* and *R. viridis*. The first group is characterized by a very long trill, whereas the second group by clear harmonics and the presence of two phases that differ in pulse repetition rate. The call of the third group is neither very long nor with different phases. The type A note of *R. prasinatus* is similar to the note of *R. viridis* in the temporal and frequency characteristics (see the sonogram in Maeada & Matsui 1989). Therefore, the species would be grouped into the third group if only the type A note is considered. However, in *R. prasinatus* the type B and C notes usually follow the type A note , and this pattern can be well compared to the complex phases seen in frogs of the second group (*R. moltrechti* and *R. owstonii*). Thus, *R. prasinatus* seems to be acoustically intermediate between the second and the third groups.

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Zusammenfassung

Für 3 Ruftypen des Baumfrosches *Rhacophorus prasinatus* von der Insel Taiwan wurde die Varianz verschiedener Strukturparameter analysiert. Im Gegensatz zu früheren Befunden erwiesen sich Rufe des Typs B als deutlich gepulst. Frequenzparameter variieren, aber nicht mit der Temperatur korreliert. Die Dauer der Rufe sinkt und ihre Wiederholungsrate steigt mit zunehmender Temperatur. Die Strukturmerkmale der Werberufe von *R. prasinatus* sind intermediär zu denen von *R. viridis* einerseits und *R. owstoni* andererseits.

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Description of the advertisement calls of some South American Hylidae (Amphibia, Anura): taxonomic and methodological consequences

Ignacio De la Riva, Rafael Márquez & Jaime Bosch

Abstract. Calling behavior and advertisement call structure of five hylid species from South America are described. Characteristic audiospectrograms and oscillograms are presented, as well as numerical information on spectral and temporal features of the calls of each species. Variation in different call parameters is compared with previously published descriptions of the advertisement calls of these species. Taxonomic and methodological issues of the use of bioacoustical data are discussed. The recognition of *Hyla walfordi* and *Scinax parkeri* as valid taxa is recommended.

Key words. Anura, Hylidae, *Hyla albopunctata, H. carnifex, H. granosa, H. walfordi, Scinax quinquefasciata, S. parkeri*, Bolivia, Ecuador, advertisement calls.

Introduction

Anuran vocalizations play a crucial role as mechanisms for species recognition and are essential components of the characterisation of species accounts. In tropical anurans relationships among taxa are particularly complex, and comparisons of advertisement calls represent an alternative way of determining differences and affinities based on a quantifiable parameter (e. g. Hödl 1977; Schlüter 1979, 1980, 1981; Duellman & Pyles 1983; Zimmerman 1983; Zimmerman & Hödl 1983; Zimmerman & Bogart 1984).

In this paper we contribute to the knowledge of some South American species of hylid frogs by studying the acoustic characteristics of their advertisement calls. This report is a complement to previously published reports of other species of hylids from the Amazonian region (Márquez et al. 1993, De la Riva et al. 1994; 1995) from recordings obtained in Bolivia and Ecuador. The objectives of this paper are to (1) describe the advertisement calls of five species, (2) compare our findings to previous descriptions, (3) discuss taxonomic issues for some of the species studied, and (4) comment about the methodological problems associated with the study of bioacoustics in anurans.

Materials and methods

Recordings were obtained in Ecuador and Bolivia. Recording equipment included either a Sony WM D6C or a Sanyo M1120 tape recorder and a Sennheiser Me 80 directional microphone. An audiospectrogram and oscillogram were obtained for a 2.5 s recording segment of each species. A longer recording (20—60 s) of a single male was analyzed to obtain numerical information on the spectral and temporal characteristics of the calls. The characteristic call was selected based on quality of the recording and on the subjective criteria of a learned human listener who perceived the call as a "normal" advertisement call of the species (i. e., the call was not emitted in specific situations which could indicate that they would be reciprocation, release, or distress calls and so on).

Digitalization and editing were completed with a Macintosh-based digital signal analysis system at a sampling frequency of 44.1 kHz and 16 bit resolution with Sound Tools hardware and software. Signalyze software was used to obtain numerical information and to generate audiospectrograms and oscillograms. Information on frequency domain was obtained through fast Fourier transform (FFT) (width 1024 points). Advertisement call terminology follows Heyer et al. (1990).

A total of 10 different call characteristics were considered. The variables considered were: number of notes per call, note duration, fundamental frequency, dominant frequency, other frequency with substantial energy, number of pulses per note, pulse rate (pulses/s), pulse ratio (pulse duration/pulse period), note repetition rate (notes per min within the call), and call repetition rate (calls per min). Unless otherwise specified, individual sizes (snout-vent length, SVL) were measured from collected individuals which were deposited in the Museo de Historia Natural "Noel Kempff Mercado", Santa Cruz de la Sierra, Bolivia. No specimens were collected in Ecuador.

Results

An audiospectrogram and an oscillogram is presented for a 2.5 sec. section of the call of each species (Figs. 1 to 5). A summary of the numerical information from the sound analyses is shown in Table 1.

Hyla albopunctata Spix, 1824 is a medium-sized species [SVL males = 60 mm (Cei 1980] of the *H. albopunctata* group. It occurs in the cerrado domain of Central Brazil, northeastern Argentina, and eastern Paraguay. Our recordings were obtained from a single male calling from a marshy area at camp Huanchaca I, Noel Kempff Mercado National Park, Santa Cruz Department, Bolivia (13° 54' S / 60° 47' W). This is the first record of the species for Bolivia. The only calls recorded were composed of a sequence of three loud, single pulsed notes repeated at regular short inter-

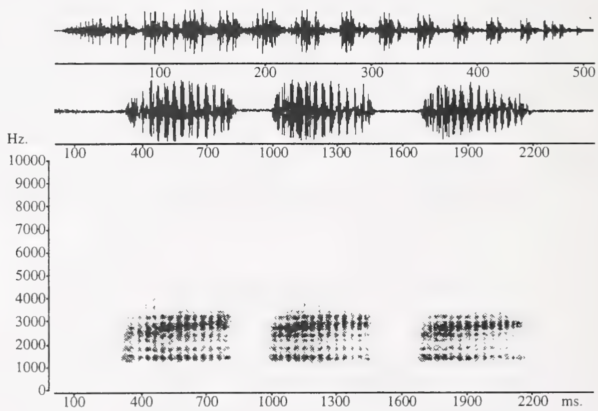

FIG. 1

Figs: 1—5: Audiospectrograms and oscillograms of a characteristic advertisement call. Fig. 1 *Hyla albopunctata*, Fig. 2 *Hyla carnifex*, Fig. 3 *Hyla granosa*, Fig. 4 *Hyla walfordi*, Fig. 5 *Scinax quinquefasciata*.

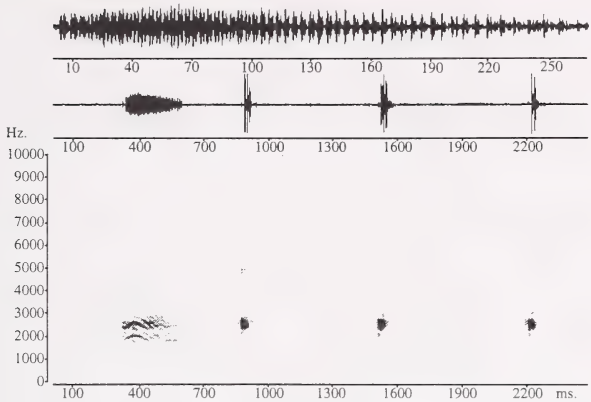

FIG. 2

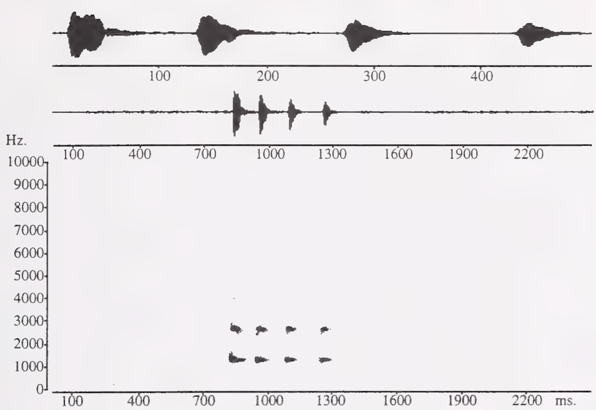

FIG. 3

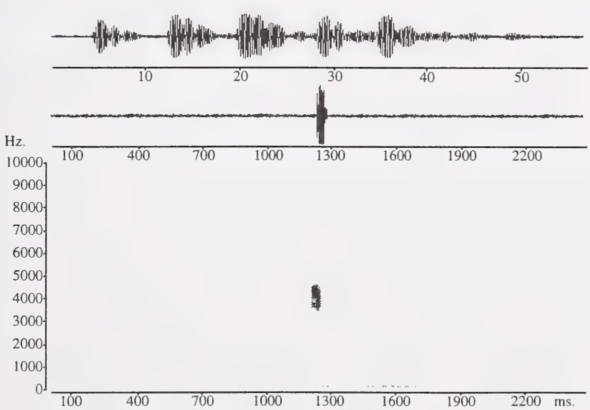

FIG. 4

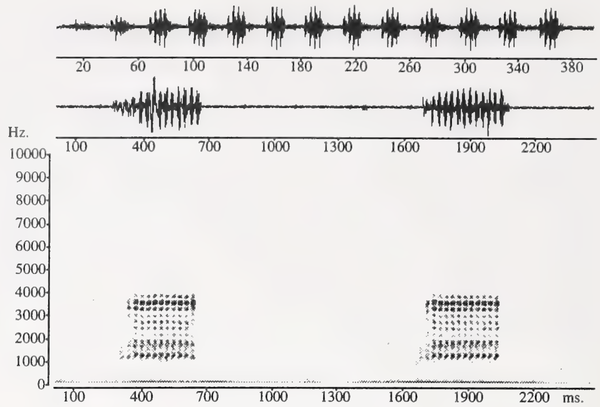

FIG. 5

vals (Fig. 1). The structure of the individual pulses was strongly amplitude-modulated, showing sub-pulses. The calls showed substantial energy in the 1300—3300 Hz range, with an average dominant frequency of 2692.3 Hz. The dominant frequency increased gradually towards the end of the call (average increase, 289.4 Hz, range 201.9—424.0 Hz).

Hyla carnifex Duellman, 1969 is a relatively small species [mean SVL males = 26.1, Duellman (1969)] in the *H. columbiana* group that occurs in the Pacific Andean slopes of Colombia and Ecuador. Our recordings were obtained in Las Palmeras, Pichincha Province, Ecuador (00°17' S / 78° 45' W) where males called at night on the vegetation near a river bank, concurrently with males of *Centrolene ballux*. The advertisement call consisted of two note types: a long note (265 ms duration) followed by a sequence of three short notes (34 ms duration). The long note is frequency-modulated and tonal in its first half, becoming more pulsed towards the end. The short notes are more pulsed (3 pulses per note), showing some power in the second harmonic (Fig. 2). The dominant frequency of both note types is concentrated around 2400 Hz.

Hyla granosa Boulenger, 1882, is a medium-sized species (males, 54 mm SVL) of widespread occurrence in the Upper Amazon Basin and Guianas and belongs to the *Hyla punctata* group. It has been observed (in Ecuador, Peru and Bolivia), calling from large leaves (as those of the "elephant ear" plants, *Heliconia*, etc) near or above ponds. In two of the three localities where the species was observed, it was calling in association with *Hyla lanciformis*. The recording shown in Fig. 3 was obtained near the River Napo, Ecuador (00° 25' S / 77° 47' W). The call consisted of a series of two to seven short notes of decreasing intensity. The notes were tonal and well-tuned, with a mean dominant frequency of 1327 Hz and substantial power in the second harmonic (2650 Hz). The mean duration of the notes was 46 ms.

Hyla walfordi Bokermann, 1962 is a small species (SVL males = 23 mm) of the *H. microcephala* group. Recordings were obtained in a flooded, open area at Flor de Oro, on the Bolivian bank of the Guaporé river (13° 33' S / 6° 00' W). This is the

first record of the species for the country, although its occurrence in Bolivia was already suspected (Langone & Basso 1987; De la Riva 1990). The only other species heard calling concomitantly was *Scinax parkeri*. The call is an extremely brief note (average duration, 38 ms) with most of its energy in the 3400—4400 Hz range. An average of five pulses (range 4—7) were discernible in the structure of the note (Fig. 4).

Scinax quinquefasciata (Fowler, 1913) is a relatively small species [35 mm SVL in both sexes (Duellman 1971)] of the *S. rubra* group. It occurs in the Pacific lowlands of Colombia and Ecuador. Recordings were obtained in Same, Esmeraldas Province, Ecuador (00° 50' N / 79° 55' W) where males called from a grassy area near a small stream in the mangrove. *Trachycephalus jordani* and *Bufo marinus* were the only other anuran species that were found there. The call is composed of a single note, 472.5 ms average duration, with a variable number of pulses (average 16 pulses/note) and a complex spectral structure (range 1400—4000 Hz) with a dominant frequency of 3446.2 Hz (Fig. 5). The call was repeated at a relatively fast rate (average 29.2 calls/minute).

Discussion

Cardoso (1981) analyzed calls of *H. albopunctata* from Campinas, Brazil. He distinguished a nuptial call and a territorial call (both considered, in a broad sense, as "advertisement calls"). He found that the nuptial call has a higher number of pulses and is slightly higher pitched than the territorial call, and that both calls consist of two notes, sometimes followed by a third, different note. Aside from a high number of pulses (118) in the first note of the nuptial call (that we considered equivalent to our subpulses) and a longer note duration (600 ms) in the specimens from Campinas, our results are in general agreement with Cardoso (1981). Haddad et al. (1988) described the calls of *H. albopunctata* from Serra da Canastra, Minas Gerais, Brazil. They described a call typically consisting of a series of two pulsed notes separated by an interval of 200 ms, the first one having a duration of 500 ms and the second one being longer (900 ms). Occasionally they perceived a third note which was shorter but louder. They determined through playback tests that the third note found to be particularly effective in eliciting calling by other males. Our recordings do not coincide with their description since only one type of note was heard in Bolivia. Heyer et al. (1990) described the call of *H. albopunctata* from Boracéia (Brazil). Their description does not coincide with ours to the extent that they described two different note types. Their type I note was not heard in the Bolivian specimens. However, our description vaguely resembles their type II note in duration, frequency range, and structure (strong side bands) but differs in that they do not find frequency modulation and we find that the upper emphasized harmonic shows an upwards frequency sweep (2800—3100 Hz). Differences in all these results appear to be due to the different social context in which frogs were at the time of recording.

Duellman & Trueb (1983) provided an accurate description of the call of *H. carnifex* from a locality close to ours. Although they found a larger number of calls per minute than us, the rest of the data are coincident.

Table 1: Summary of numerical parameters of the vocalizations.

	Individuals analyzed	Notes analyzed	Notes per call	Note duration (msec)	Fundamental frequency (Hz)	Dominant frequency (Hz)	Other frequency (Hz)	Pulses/ note	Pulses/ second	Pulse duration/ pulse period	Notes/ minute	Calls/ minute
H. albopunctata	1	3	–	461.4 (29.3) 428.3–484.1	1332.7 (20.2) 1312.5–1352.9	2692.3 (11.7) 2685.6–2705.8	–	12.3 (0.6) 12–13	26.8 (1.7) 24.8–28	0.6 (0.1) 0.4–0.9	94.3 (9.7) 87.4–101.3	–
H. carnifex Long	1	2	1	263.5 (11.8) 255.2–271.9	2433.2 (14.3) 2423.1–2443.3	2433.2 (14.3) 2423.1–2443.3	1918.3 (28.6) 1898.1–1938.5	56.5 (0.7) 56–57	214.5 (6.9) 209.6–219.4	–	–	4.2
Short	1	6	3	34.3 (6.3) 29–44.1	2490.4 (39.7) 2423.1–2544.2	2490.4 (39.7) 2423.1–2544.2	4876.4 (83.5) 4765.4–4987.5	3 (0) 3–3	89.7 (14.8) 68–103.4	0.7 (0.1) 0.6–0.9	91.1 (4.9) 85.8–95.7	–
H. granosa	6	23	2.9 (1) 2–5	40 (10.7) 21.2–72.1	1426.9 (26.4) 1352.9–1453.8	1426.9 (26.4) 1352.9–1453.8	2861.2 (57.1) (2705.8–2927.9)	–	–	1	415.9 (67.5) (281.6–679.5)	21.8 (10.7) 8.7–47.8
H. walfordi	5	15	1	38.8 (6.6) 25.4–46.6	4282.2 (184.3) 4038.5–4583.7	4282.2 (184.3) 4038.5–4583.7	3811.3 (257.6) 3574–4401.9	5 (0.7) 4–6	130.5 (13) 107.3–157.5	0.7 (0.1) 0.3–0.9	8.4 (3.2) 4.3–12.1	8.4 (3.2) 4.3–12.1
S. quinquefasciata	1	12	1	335.5 (112.4) 168.3–577.5	1156.1 (12.6) 1130.8–1171.2	3446.2 (24.9) 3392.3–3473.1	6108.2 (14.3) 6098.1–6118.3	11.8 (3.9) 6–20	35.2 (0.5) 34.4–35.9	0.6 (0.1) 0.5–0.7	29.2 (9.8) 17.4–46.3	29.2 (9.8) 17.4–46.3

Duellman (1978) and Duellman & Pyles (1983) described the call of *H. granosa* from Santa Cecilia, Ecuador, a locality close to ours. The three sets of data are consistent. Our audiospectrogram of the characteristic advertisement call of *H. granosa* (Fig. 3) also closely resembles the description from Surinam published by Hoogmoed (1979). The audiospectrogram in Schlüter (1979) shows great similarity to ours as well, although we do not find the upwards frequency modulation shown in the second harmonic found in Peruvian frogs. Both our audiospectrogram and the numerical data obtained for the sound samples are comparable to the calls described by Zimmerman & Bogart (1984) for frogs recorded in Tapajós (Brazil). Cardoso & Vielliard (1990) also described the call of Brazilian specimens of *H. granosa*. Their data coincide with ours except for the characteristic three or four notes per call that we found. Their specimens emitted one or two notes per call.

The comparison of the calls of *H. walfordi* and *H. nana* Boulenger, 1889 can provide some insight in the taxonomic validity of the former species. The taxonomic status of *H. walfordi* has been controversial. This species was placed in the synonymy of *H. nana* by Lutz (1973), which was followed by Duellman (1977) and Frost (1985), but not by Heyer (1976; 1977). Langone & Basso (1987) resurrected *H. walfordi* based on comparisons of preserved specimens and supposed differences in the mating call [Cardoso, in Langone & Basso 1987)]. However, Duellman (1993) did not include the species in his additions and corrections to Frost's (1985) list. Living specimens of this species can be differenciated from those of *H. nana* by the shape of the snout and some features of the color pattern (Langone & Basso 1987; De la Riva pers. obs.). Furthermore, if we compare the calls of *H. walfordi* with those of *H. nana* obtained with similar analysis and recording equipment (Márquez et al. 1993: 437, 438), substantial differences can be found in call structure, since *H. walfordi* has a markedly pulsed call structure which is much less evident in *H. nana*. The call of this species is much more tuned and therefore sounds much more tonal than the calls of *H. walfordi*. Based on these observations, we support the recognition of *H. walfordi* as a valid species. Langone & Basso (1987) suggested that the taxonomic status of the small yellow frogs commonly ascribed to *H. nana* in the central and northern Amazon basin should be reconsidered. Hödl (1977) provided analyses of the call of a so-called *Hyla* cf. *nana* frog from Manaus, which supposedly could be actually *H. walfordi*. Comparisons of his data with ours do not support this hypothesis. The number of calls/minute (159) in *H.* cf. *nana* is by far higher than in *H. walfordi* ($\bar{x}$ = 8.4). The mean dominant frequency is also a little higher (4835 Hz vs. 4282) and the note duration is much shorter (12 ms vs. 38.3). In fact, the call of *H.* cf. *nana* seems to be more similar to that of *H. nana*, although *H. nana* shows a lower dominant frequency (4526 Hz), a longer note duration (38.3 ms) and a lower number of calls/minute (103) (Márquez et al. 1993). Thus, from these data, no definite conclusion seems evident regarding the taxonomic status of *H.* cf. *nana*. It seems plausible that *H.* cf. *nana* is really *H. minima* Ahl, 1933, or an undescribed species in the *H. microcephala* group (see Zimmermann & Rodrigues 1990). Finally, Langone & Basso (1987) stated that the characteristics of the calls of *H. minuscula* Rivero, 1971 from Venezuela provided by Rivero (1971) are not consistent with those of the same species from Belém, Brasil, recorded by Duellman & Pyles (1983), and Langone & Basso (1987) recommended a reassessment of the taxonomic status of the Brazilian

population. Langone (pers. comm.) suggested that it could be *H. walfordi*. However, direct comparisons of Venezuelan specimens of *H. minuscula* in the collection of the Museum of Natural History, The University of Kansas (KU 167131-43) with those from Belém (KU 127646-745) indicate that they are conspecific. Thus, the occurrence of *H. walfordi* in Belém is not supported by the available data.

Duellman (1971) described the calls of specimens of *S. quinquefasciata* recorded in Santo Domingo de los Colorados, Ecuador, a locality about 150 km southeast (air line) from ours. Although the frequency range and the general structure of the call coincides with our recordings, other characteristics such as the pulse rate [65 pulses / second in Duellman (1971)] remain rather different to our data (35 pulses / second). In addition, the note duration that is represented in the audiospectrogram depicted by Duellman (1971: 216) is about 300 ms in duration, a value that is within the ranges that we find (168—1978 ms) but the range and average duration reported in the text by Duellman (140—150 ms, average 145 ms) is lower than any of the values found by us.

In a previous paper (De la Riva et al. 1994) we described the call of *Scinax parkeri* (Gaige, 1929) from Bolivia, and we stated that no recordings of the species had been published. Actually, we overlooked Duellman & Pyles's (1983) numerical data from recordings obtained in Belém, although they did not show sonogramas or oscillograms. Our results are not consistent with those of Duellman & Pyles. Calls from Bolivian specimens have a higher mean number of notes/minute (151.1 vs. 27.6), are much shorter (185.7 ms vs. 640), have less pulses/s (100.2 vs. 177), and show a lower dominant frequency (2777 Hz vs. 4558). These data seem to belong to different species. *Scinax parkeri* has been considered by some authors (Lutz 1973; Frost 1985; De la Riva 1990) as a synonym of *S. fuscomarginata* (A. Lutz, 1925), a species occurring in southeastern Brazil. However, Duellman & Wiens (1992) considered *S. parkeri* as a valid species, without explanation. There are two other species of the perplexing *S. staufferi* group described from this part of the Amazon basin, *S. goinorum* (Bokermann, 1962) and *S. madeirae* (Bokermann, 1964) [the later placed also in the synonymy of *S. fuscomarginata* by Lutz (1973)]. All these species look quite similar in appearance. The call of *S. fuscomarginata* was described by Cardoso (1981) from specimens recorded in Campinas. He found a single kind of note when individuals were calling alone, and two notes when they were calling in pairs. All the parameters allowing comparisons from Cardoso (1981) and De la Riva et al. (1994) show strong differences between the calls of *S. fuscomarginata* and *S. parkeri*. Because our recordings of *S. parkeri* were obtained at Buenavista (type locality of the species) while Cardoso's were obtained from the state of São Paulo (type locality of *S. fuscomarginata*), we conclude that *S. parkeri* is a valid species. On the other hand, data by Cardoso (1981) are quite similar to those by Duellman & Pyles (1983). A reassessment of the taxonomic status of all the described Amazonian species in the *S. staufferi* group is needed.

As we have seen, the vocalizations of some of the species studied were already described from different localities by other authors. Comparisons with those previous reports sometimes showed concordant results. In other cases, potential inconsistencies were revealed which would suggest lines for further research. The problem is frustrating in some of these cases, because inconsistencies may be due to

a vast array of causes. First, slight intraspecific regional variations in the advertisement calls may exist. Among other reasons, these variations may be a response to slightly different acoustic niche availability in different communities. The different composition of anuran communities from site to site may drive a particular species to expand or squeeze its acoustic niche, depending on particular acoustic constraints. For example, recordings of *Leptodactylus mystaceus* from Peru differ markedly from recordings of the same species obtained in Bolivia. This may be due to the presence in Bolivia of a second species with a similar call, *L. elenae*, or to the fact that two species may actually be involved under the name *L. mystaceus* (Márquez et al. 1995). While this paper was in press, Heyer et al. (1996, Amphibia-Reptilia 17: 7—31) described *Leptodactylus didymus* from SE Peru, confirming this hypothesis. Particular conditions at the time of the recording (i.e., temperature), as well as some characteristics of the frogs themselves (i.e., size or social context) may also affect the results. In this sense, there are different kinds of calls among those commonly considered as "advertisement calls". A male can modify some features of the call if there is another male close to it, even though they are not involved in a duet. In such a case, it is very common that the "normal" structure of the call undergoes some sort of change. For the researcher not familiar with the vocalizations of a particular species, it may be difficult to interpret and distinguish what kind of call is being recorded. Finally, there may be differences in the way in which recordings are obtained, analyzed, and presented, and there are many different kinds of recorders, microphones, vibralizers, hardware, software, and so forth. Thus, it is necessary to be as careful as possible before making taxonomic guesswork derived from these comparisons. Furthermore, we know little about the intraspecific variation of the mating calls in Neotropical anurans. We suggest that unless strong differences are found, no taxonomic implications should be supposed in the absence of another kind of evidence. If material and procedures, as well as the pertinent biological information, are not thoroughly explained, confusion and erroneous conclusions will result. If we wish to establish useful comparisons between data of recordings by different researchers, a standardization of the methods, variables considered, and terminology employed is needed.

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Zusammenfassung

Das Rufverhalten und die Struktur der Werberufe von 5 südamerikanischen Hyliden-Arten werden anhand von Oszillogrammen und Lautspektrogrammen sowie Messungen ihrer Strukturparameter darin beschrieben. Die Varianz der einzelnen Parameter wird mit bereits dazu

publizierten Befunden verglichen. Taxonomische und methodische Aspekte der Verwendung bioakustischer Daten werden diskutiert. *Hyla walfordi* und *Scinax parkeri* sollten als eigenständige Arten anerkannt werden.

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Bonn. zool. Beitr.	Bd. 47	H. 1—2	S. 187—188	Bonn, September 1997

A note on the gender of the genus *Podarcis* (Sauria: Lacertidae)

Wolfgang Böhme

According to article 34 b of the International Code of Zoological Nomenclature (ICZN) species (and subspecies) names "must agree in gender with the generic name with which it is at any time combined; if the termination is incorrect it must be changed accordingly" (ICZN 1985). This article has quite often been neglected in the taxonomic/nomenclatural practice. Some popular herpetological examples of recent corrections of a long-term wrong usage are *Uromastyx* (feminine; Agamidae: Lanza 1983), *Adelphicos* (neuter; Colubridae: LaDuc 1995) or *Scinax* (masculine; Hylidae: Köhler & Böhme 1996).

Arnold (1973) reinstated the generic name *Podarcis* Wagler, 1830 as a full genus and referred to Fitzinger (1843) as the first author who fixed a type (cited in the original combination: *Seps muralis* Laurenti, 1768). The species concerned had mostly been mostly regarded as a subgenus of *Lacerta* before (for a detailed discussion see Böhme 1986). In his original description, Wagler (1830) assigned three species to his new genus *Podarcis*, viz. "*Seps muralis* Laur." (= *Podarcis muralis*), "*Lacerta velox* Pall." (= *Eremias velox*) and "*Lacerta grammica* Lichtenst." (= *Eremias grammica*). It was Fitzinger (1843) who subsequently selected and designated *Seps muralis* Laurenti (being likewise of masculine gender!) as the type species of *Podarcis* (see also Loveridge 1957, Arnold 1973).

When Arnold (1973), elevated *Podarcis* to full generic rank again, he did not refer to its gender and consequently left the terminations of the species names (which had been adapted to the feminine gender of their former genus *Lacerta* before) unchanged. The Greek word "podarkis" is an adjective meaning "swift-footed, nimble". In his original description, Wagler (1830) used the Latin translation "pedibus celer" to give the etymology of *Podarcis*. As he generally did not combine his new generic names with a specific type species, but rather cited the assigned species in their original combinations (e.g. *Seps muralis*, see above), he never made decisions as to the gender of his new generic names. This is also true for *Podarcis*, a word derived from a Greek adjective. However, according to article 11 g of the Code (ICZN 1985) "a genus-group name must be or be treated as a noun in the nominative singular", "podarkis" in his latinized spelling *Podarcis* has to be treated as a noun of masculine gender for the following reasons:

— Wagler was surely aware of "podarkis" being an adjective particularly attributed to the ancient hero Achilleus in the classic Greek (Homerian) literature, i.e. a clearly masculine attribution! The three species assigned by him (1830) to his new genus name were (1) *Seps muralis* (*muralis* here being masculine, too, because of the gender of *Seps*!), (2) *Lacerta velox*, and (3) *Lacerta grammica* (*velox* and *grammica* being feminine due to their combination with *Lacerta*). Wagler, therefore, did not make a formal decision as to the gender of *Podarcis*, but by no means considered this name to be feminine!

— Fitzinger (1843) was the first to subsequently and explicitly select a type for *Podarcis*, viz. *Seps muralis*, which was the masculine one out of Wagler's three names. His treatment has to be accepted as the establishment of gender.

The consequence of accepting *Podarcis* as masculine requires to change the endings of those species of *Podarcis* that have a specific feminine termination. These are: *Podarcis hispanica* (to *P. hispanicus*), *P. peloponnesiaca* (to *P. peloponnesiacus*), *P. sicula* (to *P. siculus*), *P. taurica* (to. *P. tauricus*), and *P. wagleriana* (to *P. waglerianus*). In the case of *P. tiliguerta*, however, the situation is different, as *tiliguerta* is not an adjective but an old-Sardian noun meaning lizard (Corti, pers. comm.). Therefore, this termination is not affected by the gender of the genus name. Of the remaining species of *Podarcis*, of course all feminine subspecific endings

have to be changed accordingly. *P.* (*Teira*) *perspicillata* is not affected by this change, as it has recently been transferred to a full genus *Teira* by Mayer & Bischoff (1996), thus remaining feminine in gender. The elevation of another subgenus of *Lacerta*, viz. *Timon* Tschudi, to full generic rank (Mayer & Bischoff 1996) also causes the change from *L. lepida* to *T. lepidus*.

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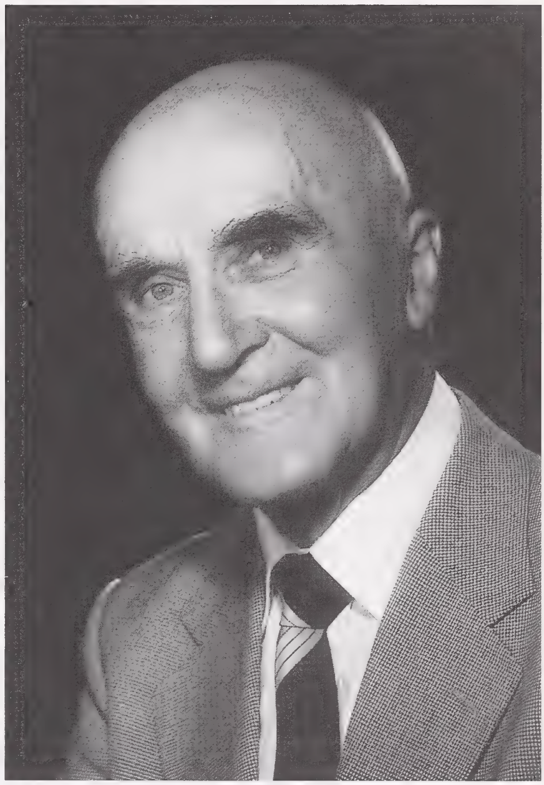
Bonn. zool. Beitr.	Bd. 47	H. 1—2	S.189—190	Bonn, September 1997

Zum Gedenken an Hans Kumerloeve

C. M. Naumann



Am 11. 8. 1995 verstarb in München nach dreimonatiger schwerer Krankheit Museumsdirektor i.R. Dr. Hans Kumerloeve, bis dahin und seit 1970 einziger ehrenamtlicher wissenschaftlicher Mitarbeiter des Museums Koenig. Kumerloeve war einer derjenigen biogeographisch und systematisch arbeitenden Wirbeltierkundler, die bereits zu Lebzeiten zu einer Legende ihrer selbst geworden sind. Am 5. September 1903 in Leipzig geboren, hatte er das große Glück, schon im Elternhaus viel Verständnis und Unterstützung für seine naturwissenschaftlichen Neigungen zu finden. So ergab es sich fast von selbst, daß er nach dem Abitur an der Leipziger Universität ein Studium der Naturwissenschaften aufnahm. Dort traf er bald mit einem anderen sächsischen Biologen zusammen, dessen Herz ebenso wie das von Hans Kumerloeve der Ornithologie gehörte: Günther Niethammer, dem späteren langjährigen Leiter der Ornithologischen Abteilung des Museums Koenig. Kumerloeve gelang es, auch Niethammer dazu zu bewegen, eine Doktorarbeit bei dem damaligen Inhaber des Lehrstuhls für Zoologie in Leipzig, Prof. Dr. Johannes Meisenheimer, zu beginnen. Nach der erfolgreichen Promotion „Vergleichende Untersuchungen über das Gonadensystem weiblicher Vögel" (3 Bände), Note: summa cum laude, schlug Kummerlöwe (später: Kumerloeve) ein Angebot Meisenheimers, bei ihm als Assistent zu arbeiten, aus und folgte seinen eigenen wissenschaftlichen Interessen mit einer von der Notgemeinschaft der deutschen Wissenschaften finanzierten Studie zur Vogelfauna des Alpenraumes, in deren Verlauf er auch längere Zeit an den reichen Sammlungen des Wiener Naturhistorischen Museums arbeiten konnte.

Den Grundstein zu seinem wissenschaftlichen Hauptarbeitsgebiet aber legte eine im Jahre 1933 auf einem kleinen Motorrad gemeinsam mit Günther Niethammer durchgeführte ornithologische Studienreise in die nördliche und westliche Türkei. Noch im gleichen Jahr waren die beiden Zoologen schon wieder in der Türkei, um sich dort Eindrücke vom herbstlichen Vogelzug zu verschaffen. Bereits aus diesen beiden ersten Reisen resultierten mehrere grundlegende faunistisch-zoogeographische Arbeiten. Zunächst allerdings übernahm Kumerloeve im Jahre 1936 die Leitung der Staatlichen Museen für Tier- und Völkerkunde in Dresden, um bereits 1939 nach Wien zu wechseln, wo er zum Ersten Direktor der Wissenschaftlichen Staatsmuseen ernannt worden war. Seine Beziehungen zum Gründer unseres Instituts sind zumin-

dest bis in die Zeit vor dem Amtsantritt in Dresden nachweisbar, da Alexander Koenig ihm in einem persönlich gehaltenen Handschreiben, das sicherlich auf älteren Kontakten aufbaut, zu seiner Ernennung in Dresden gratulierte.

Nach dem zweiten Weltkrieg sehen wir Hans Kumerloeve als Museumsdirektor i.R. zuerst in Osnabrück und ab 1964 in Gräfeling bei München. Seit Beginn der 50er Jahre fand er mit unermüdlichem Eifer zu seinem eigentlichen Arbeitsgebiet, der Erforschung der Vogel- und Säugetierfauna des Vorderen und Mittleren Orients. Für Reisen erhielt er mehrfach die Unterstützung der Deutschen Forschungsgemeinschaft, die auch die Drucklegung seiner „Bibliographie Säugetiere und Vögel der Türkei" (Bonn. zool. Monogr. 21, 1986) mitfinanzierte. Die Auswertung seiner reichen Sammel- und Beobachtungstätigkeit führte Hans Kumerloeve regelmäßig zu kürzeren, in den 50er bis 70er Jahren auch längeren, manchmal mehrwöchigen Aufenthalten an das Museum Koenig, in dessen Obhut auch die umfangreichen ornithologischen und theriologischen Sammelausbeuten gelangten. Hier war er Dauergast und konnte 1967 auch einen Mitarbeiter des Museums, Heiner Mittendorf (heute: Klein Windhoek/Namibia), als Begleiter und Assistenten seiner Reisen gewinnen. Seine unkonventionelle, ja vielfach burschikose Umgangsweise und seine fundierten geographischen, biologischen und historischen Kenntnisse des Vorderen Orients brachten Hans Kumerloeve großen Respekt ein. Hierbei spielte auch sein besonderes Engagement für den Erhalt der Tier- und Pflanzenwelt dieses Raumes eine besondere Rolle. Seine Bemühungen um den Erhalt der türkischen Populationen des Waldrapps am Euphratufer bei Birecik haben ihn weit über die Grenzen Deutschlands hinaus bekannt gemacht. Um so bedauerlicher ist es, daß es trotz intensiver Unterstützung durch türkische Politiker und Wissenschaftler nicht gelang, diese letzte große Waldrapp-Population Asiens zu erhalten. Überhaupt war Hans Kumerloeve stets bestrebt, seine Erkenntnisse nicht nur in europäischen Fachzeitschriften zu publizieren, sondern sie auch in der Türkei als seinem ständigen „Gastland" verfügbar zu machen. Somit pflegte er eine rege Korrespondenz mit türkischen Fachkollegen und publizierte auch in türkischer Sprache, so unter anderem in den Mitteilungen der naturwissenschaftlichen Fakultät der Universität Istanbul (İstanbul Üniversitesi Fen Fakültesi Mecmuası). Sein wissenschaftliches Gesamtwerk umfaßt rund 400 Publikationen.

Hans Kumerloeves wissenschaftliche Arbeiten über die Türkei fanden weit über die Grenzen der Bundesrepublik hinaus Beachtung und brachten ihn in Kontakt mit Wissenschaftlern in nahezu allen Erdteilen. Sie legten wichtige Grundsteine für das spätere Engagement vor allem britischer und niederländischer Ornithologen, das noch im Jahre 1995 mit der Publikation der "Songbirds of Turkey — an Atlas of Biodiversity of Turkish Passerine Birds" durch C. S. Roselaar einen vorläufigen Höhepunkt erreichte. Der Verfasser hat dieses wichtige Grundlagenwerk Dr. Hans Kumerloeve in Anerkennung seiner Leistungen für die Erforschung der türkischen Vogelwelt und für den Naturschutz im Mittleren Orient gewidmet. Leider hat Hans Kumerloeve das Erscheinen dieses Werkes nicht mehr miterleben dürfen. Es wäre ihm sicherlich eine tiefe Genugtuung gewesen zu sehen, daß seine Bemühungen nun von anderen weitergetragen und verfolgt werden.

Noch zu Beginn der 90er Jahre hatten wir mehrfach die Ehre und das Vergnügen, Hans Kumerloeve unter uns im Museum Koenig zu sehen. Oft wurde er dabei von seiner Frau Gertraude begleitet, die ihn im übrigen — wie zahlreiche Danksagungen in den Veröffentlichungen belegen — auf den meisten der Expeditionen begleitet hat, tatkräftig präparierend und die technischen Dinge des Reisealltags in schwierigem Gelände meisternd. Im Zusammenhang mit dem Ausbau unseres historischen Archivs unterstützte er uns durch die Überlassung von Briefen Alexander Koenigs und anderen Schriftgutes aus der Gründerzeit unseres Instituts. Seinen beschwingten Schritt, seine markante Figur und sein stets humorvolles, der Sache verbundenes Wesen werden wir vermissen. Die Mitarbeiterinnen und Mitarbeiter des Museum Koenig werden Hans Kumerloeve stets ein liebevolles Andenken bewahren.

Prof. Dr. C. M. Naumann, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, 53113 Bonn.

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Buchbesprechungen

Vogelstimmen im Wald. CD Nr. 404.025, AMPLE Edition Musikverlag, Germering.

Die Zahl der digitalen Tonträger mit Tierstimmenaufnahmen, die man käuflich erwerben kann, nimmt ständig zu. Die zur Besprechung vorliegende CD gehört mit weiteren 3 zu einer Serie von 4 CDs mit den Stimmen von insgesamt 100 heimischen Wildvogelarten. Dieselbe Serie ist auch auf MC erhältlich. Ein kleines Beiheft enthält in Stichworten eine sehr kurze Minimalinformation zu jeder der Arten, einen kurzen einführenden Begleittext, bisweilen auch mit Erläuterungen zu der jeweiligen Tonaufnahme, und je ein Photo der 25 Vogelarten, die mit Lautäußerungen auf dieser CD vertreten sind.

Einige Arten wie Klappergrasmücke, Grauschnäpper oder Turteltaube, die mit ihren Gesängen auch auf dieser CD vertreten sind, kann man aufgrund ihres hauptsächlichen Vorkommens sicherlich kaum als ausgesprochene Waldvögel bezeichnen. Die Auswahl der für die einzelnen Vogelarten präsentierten Lautformen erscheint bisweilen etwas unausgewogen; so wurden z. B. für den Habicht nur die Bettellaute von Nestjungen aufgenommen. Wenn diese CD als Einführung für Vogelfreunde ohne viele Vorkenntnisse gedacht ist, so sind die weniger als briefmarkengroßen Photos der einzelnen Vogelarten kaum hilfreich, um diese im Feld sicher zu identifizieren. Die Qualität der einzelnen Tonaufnahmen ist durchweg gut, und sie sind mit meist mehr als 2 Minuten Abspieldauer in der Mehrzahl auch ausreichend lang, man fragt sich aber, warum der gedruckte Text nochmals auf dem Tonträger in die Vogelstimmenaufnahmen hinein verlesen wird. Das mindert den Eindruck der Vogellaute auf den Hörer. Es wäre sinnvoller gewesen, weitere Vogelarten, die in nahezu allen Aufnahmen im Hintergrund auch zu hören sind — und das ist ja natürlich —, für den Zuhörer zu identifizieren.

Vogelstimmen-CDs wie die vorliegende sind sicherlich gut für Personen geeignet, die sich einen ersten Eindruck von den Lautäußerungen unserer heimischen Vögel verschaffen wollen. Wer sich aber eingehender damit befassen will, wird eher auf entsprechende Produkte anderer Hersteller zurückgreifen.

G. Peters, Bonn

Passarge, H. (1991): *Avizönosen in Mitteleuropa.* Ber. Bayer. Akad. Natursch. Landsch.-pflege, Beih. 8: 5—128 (diese Serie kürzt sich selbst mit Ber. ANL ab).

Avizönosen sind Lebensgemeinschaften von Brutvogelarten; Vorbild sind pflanzensiologische Einheiten. Autor sieht den Sinn der Beschreibung derartiger Gemeinschaften in der Regelhaftigkeit, mit der dieselben Arten unter vergleichbaren Lebensbedingungen stets gemeinsam vorkommen. Die Anwendung sieht er bei der Bioindikation/Umweltmonitoring, beim Natur- und Artenschutz, bei Synökologie/Synchorologie, Synzönologie (Verbund von Avizönosen) und Synethologie (Verhalten bei interspezifischem Zusammenleben).

Passarge unterscheidet 6 Kleinvogelzönosen (mit 22 Untergliederungen) und 11 Großvogelzönosen (mit 25 Untergliederungen). Beispiel: die Greifvogelgemeinschaft der Wälder und Fluren besteht aus 3 Untergliederungen, von denen eine die Bussard-Falken-Gemeinschaften (Buteoni-Falconion) ist. In dieser gibt es die Mäusebussard-Turmfalken-Gemeinschaft (Buteoni-Falconetum tinnunculi), die es in verschiedenen Ausbildungen gibt (z. B. B.-F. typicum oder B.-F. circetosum mit Rohrweihe).

Der Ansatz erinnert an das Leitarten-Konzept von Flade 1994 (Die Brutvogelgemeinschaften Mittel- und Norddeutschlands, IHW-Verlag), wobei aber Flade wesentlich näher an der Praxis liegt. Passarges Zönosen-Konzept erscheint mir zu typologisch und erstarrt sehr im Formalen.

Goetz Rheinwald, Bonn

Poot, M., L. M. Rasmussen, M. van Roomen, H.-U. Rösner & P. Südbeck (1966): *Migratory Waterbirds in the Wadden Sea 1993/94.* Wadden Sea Ecosystem 5, 79 S. ISSN 0946-896X.

Zweiter Jahresbericht der drei Anliegerstaaten Dänemark, Deutschland und Niederlande über das Monitoring rastender Vögel im Wattenmeer. Der Band enthält die Mittwinterzählungen Januar 1994, Ringel- und Weißwangengans im März und Mai sowie die ganzjährig durchgeführten Springtidenzählungen 1993/94. Mit Kormoran, 9 Gänsen und Enten, 19 Limikolen und 4 Möwen sind 33 regelmäßig vorkommende Arten behandelt. Obwohl das gesamte Wattenmeer zwischen Langli (Dänemark) und Texel (Niederlande) behandelt ist, fehlen Angaben aus dem Nationalpark Hamburgisches Wattenmeer völlig.

Wesentlicher Bestandteil ist die Umsetzung der Zählergebnisse in optisch viel einfacher zu erfassende Karten, die die Mittwinterverbreitung der einzelnen Arten nach Größenklassen zeigen. So können die artlich oft stark voneinander abweichenden wichtigen Rastgebiete auch von Außenstehenden schnell erkannt werden. Die Mittwinterergebnisse sind zusätzlich in Diagrammen mit Zählungen ab 1980 verglichen, was einen guten Einblick in die — allerdings oft von Winterwetter stark beeinflußten — winterlichen Rastbestandsentwicklungen erlaubt. Außergewöhnliche Entwicklungen und Bestände werden kommentiert, die in ausgewählten Gebieten durchgeführte Springtidenzählung wird als Monitoringmethode diskutiert.

Stefan Stübing, Schwalmstadt

HINWEISE FÜR AUTOREN

Inhalt. — *Bonner zoologische Beiträge* ist eine wissenschaftliche Zeitschrift des Zoologischen Forschungsinstituts und Museums Alexander Koenig, Bonn. In ihr werden Originalarbeiten auf dem Gebiet der systematischen und vergleichenden Zoologie veröffentlicht. Manuskripte, die Ergebnisse aus der Arbeit des Instituts präsentieren oder auf den Sammlungen des Museums basieren, werden vorrangig berücksichtigt, doch sind andere Beiträge ebenso willkommen.

Sprache. — Manuskripte können in deutscher, englischer oder französischer Sprache abgefaßt sein.

Einsendung von Manuskripten. — Manuskripte sind in zweifacher Ausfertigung zu senden an die Schriftleitung, Bonner zoologische Beiträge, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D 53113 Bonn.

Auswahlverfahren. — Manuskripte werden einem Gutachterverfahren unterzogen; die Redaktion behält sich das Recht vor, Gutachten von externen Fachleuten einzuholen.

Textgestaltung. — Manuskripte sollten inhaltlich und formal gründlich durchgearbeitet sein. Für Beschreibungen wird eine kurze und klare Ausdrucksweise empfohlen. Zitierte Literatur wird im Text abgekürzt (Autor, Jahr), die vollständigen Zitate erscheinen im Literaturverzeichnis (siehe unten). Bei Zitaten mit mehr als einem Autor benutze man das Zeichen „&" an Stelle von „und". Bei der endgültigen Abfassung des Manuskriptes sollten die Autoren eines der letzten Hefte der *Bonner zoologischen Beiträge* hinzuziehen.

Die Beschreibung neuer Taxa muß den Internationalen Regeln für die Zoologische Nomenklatur folgen. Es wird erwartet, daß die Autoren mit diesen Regeln vertraut sind und sie befolgen. Typusexemplare neu aufgestellter Taxa sollten in einem öffentlichen Museum oder Institut hinterlegt werden.

Der Aufbau des Manuskriptes sollte sich am folgenden Schema orientieren: Titel, Verfasser, Abstract, Key Words, Einleitung, Material und Methoden, Ergebnisse, Diskussion, Danksagung, Zusammenfassung, Literaturverzeichnis, Anschrift des(der) Autors(en), Abbildungslegenden, Tabellen, Abbildungen (jeweils auf der Rückseite mit Nummer und Autorenname[n] versehen). Ein kurzes Abstract in englischer Sprache, maximal 10 Key Words und eine deutsche Zusammenfassung sind obligatorisch.

Manuskripte sind durchgehend weitzeilig mit 3 cm Rand auf weiße DIN A4 Blätter zu tippen. Computerausdrucke werden nur bei ausreichender Schreibqualität berücksichtigt. Die Seiten sollten am oberen Rand fortlaufend numeriert sein. Nur wissenschaftliche Namen von Gattungen und niedrigeren Kategorien sollen unterstrichen werden, alle anderen Auszeichnungen nimmt die Schriftleitung vor.

Die Schreibweise der Literaturzitate sollte streng dem Stil der Zeitschrift folgen; Abkürzungen für Periodika entnehme man der World List of Scientific Periodicals oder einem entsprechenden Werk. Beispiele für die Zitierweise folgen:

Eisentraut, M. (1963): Die Wirbeltiere des Kamerungebirges. — Parey, Hamburg und Berlin.
Eisentraut, M. & H. Knorr (1957): Les chauve-souris cavernicoles de la Guinée française. — Mammalia 21: 321—335.
Musser, G. G., L. R. Heaney & D. S. Rabor (1985): Philippine rats: a new species of *Crateromys* from Dinagat Island. — Am. Mus. Novit. 2821: 1—25.

Bei der Planung von Abbildungsvorlagen und von Tabellen sollte der zur Verfügung stehende Satzspiegel (126 x 190 mm) berücksichtigt werden. Tabellen sollten auf ein Mindestmaß beschränkt werden, Abbildungen und Tabellen nicht den gleichen Sachverhalt darstellen. Fußnoten sind nach Möglichkeit zu vermeiden.

Korrektur. — Fahnenabzüge des Rohsatzes werden an die Autoren zur Korrektur gesandt.

Sonderdrucke. — Von jedem Beitrag werden 50 Sonderdrucke kostenlos geliefert; weitere können gegen Erstattung der Kosten bezogen werden. Bestellformular und Preisliste liegen der Korrekturfahne bei.

[English version in the next number]

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INHALT

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Report on some sigmodontine rodents collected in southeastern Brazil with descriptions of a new genus and six new species

Philip Hershkovitz †

Table of Contents

Abstract. The report is based on part of the collections of small mammals made in the Iporanga State Park, São Paulo, the Parque Nacional de Caparaó, Minas Gerais-Espírito Santo, and localities not visited in southeastern Brazil. Accounts are given of five genera (1 new) and 14 species (6 new, 1 undescribed) of sigmodontine rodents. Two earlier reports by other authors on the mammals of the Caparaó National Park are reviewed.

Key words. Rodentia, Sigmodontinae, Brazil, field survey, taxonomy, new genus, new species.

Introduction

Five field surveys of the small southeastern Brazilian mammals were conducted between 1986 and 1992 by the Field Museum of Chicago. Financial support was provided by the Barbara E. Brown Mammal Research Fund. The sponsoring and cooperative Brazilian Institutions are acknowledged individually in the account. This report deals primarily with results of studies of certain sigmodontines mostly collected in the Parque Nacional de Caparaó, Minas Gerais, the Parque Estadual Petar, Iporanga, São Paulo, and comparative material in the collections of the Field Museum.

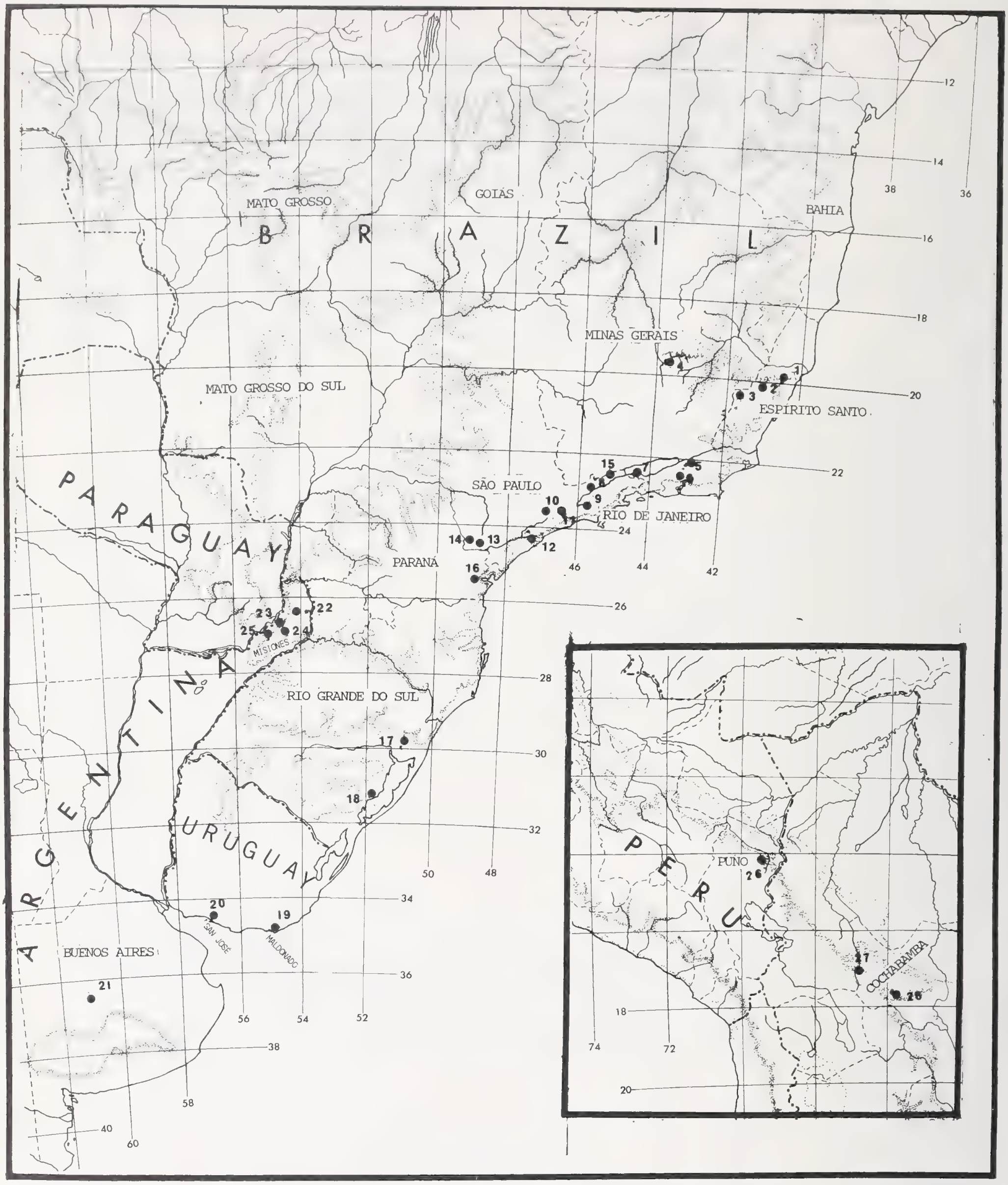


Fig. 1: Map of collecting localities mentioned in text and identified by number in gazetteer. The southeastern South American area shown is a portion of the Southeastern Zoogeographic Province.

Localities of specimens mentioned in text and plotted by number in fig. 1: 1 Santa Teresa, Espírito Santo, Brazil; 2 Engenheiro Reeve, Espírito Santo, Brazil; 3 Caparaó, Minas Gerais, Brazil; 4 Lagoa Santa, Minas Gerais, Brazil; 5 Teresópolis, Rio de

Janeiro, Brazil; 6 Centro de Primatológia, Rio de Janeiro, Brazil; 7 Itatiaya, Rio de Janeiro, Brazil; 8 Campos do Jordão, São Paulo, Brazil; 10 Cotia, São Paulo, Brazil; 11 Alto da Serra, São Paulo, Brazil; 12 Ribeirão Fundo, São Paulo, Brazil; 13 Iporanga, São Paulo, Brazil; 14 Apiaí, São Paulo, Brazil; 15 Piquete, São Paulo, Brazil; 16 Roça Nova, Paraná, Brazil; 17 Taquara, Rio Grande do Sul, Brazil; 18 São Lourenço, Rio Grande do Sul, Brazil; 19 Maldonado, Maldonado, Uruguay; 20 Arazatí, S. Ecilda, San José, Uruguay; 21 Torrecita, Buenos Aires, Argentina; 22 Tobunas, Misiones, Argentina; 23 Caraguatay, Misiones, Argentina; 24 Dos de Mayo, Misiones, Argentina; 25 Puerto Gisela, Misiones, Argentina; 26 Limbani, Puno, Perú; 27 El Choro, Cochabamba, Bolivia; 28 Colomi, Cochabamba, Bolivia.

Gazetteer of collecting localities mentioned in text
(numbers in parentheses refer to positions on map, fig. 1):

ARGENTINA
Buenos Aires
Torrecita (= Urdampilleta), 3615/6106, 108 m (21)
Misiones
Caraguatay, Río Paraná 2637/5446, 100 m (23)
Dos de Mayo, 2702/5439, 300 m (24)
Puerto Gisela, Río Paraná, 2701/5527, 50 m (25)
Tobunas, 2628/5354, 200 m (22)

BOLIVIA
Cochabamba
Muelle Muelle, 2700 m, not located
Colomi, 1731/6552, 3075 m (28)
El Choro, Ayapoc, 1656/6652, 3500 m (27)

BRAZIL
Espírito Santo
Engenheiro Reeve, 2046/4128, 400—600 m (2)
Santa Teresa, 1955/4036, 659 m (1)
Minas Gerais
Caparaó, Parque Nacional de, 2025/4147 (3)
Arrozal, 2300 m
Cachoeira Bonita, 1750 m
Centro de Visitantes, 1300 m
Pico da Bandeira, 2700 m; 2890 m
Segredo, 2100 m
Terreirão 2370 m
Tronqueira, 1970 m
Vale Encantado, 1980 m
Vale Verde, 1200 m
Espírito Santo
Pedra Roxa, 100 m
Lagoa Santa, 1938/4353, 760 m (4)
Paraná
Roça Nova, Serra do Mar, 2531/4830, 1000 m (16)
Rio de Janeiro
Centro de Primatologia, 2254/4314, sea level (6)
Fazenda Boa Fe (see Teresópolis)
Itatiaya, 2223/4438, 1800 m (7)
Teresópolis, 2226/4259, 902 m (5)

Rio Grande do Sul
Rio dos Linos [Sinos] (see Taquara)
São Lourenço (São Lourenço do Sul), 3122/5158 (18)
Taquara, 2939/5047, 29 m (17)
Taquara do Mundo Novo (see Taquara)
São Paulo
Alto da Serra (= Paranapiacaba), 2347/4619, 800 m (11)
Apiaí, 2431/4850 200 m (14)
Boraceía, Serra do Mar, 2339/4554, 800—900 m (9)
Campos do Jordão, 2244/4535, 2585 m (8)
Cotia, 2337/4656, near sea level (10)
Iporanga, 2435/4835, 200 m (13)
Piquete, Serra da Mantiquiera, 2236/4511, 600—900 m (15)
Ribeirão Fundo, 2415/4745, 30 m (12)
PERÚ
Puno
Limbani, 1408/6942 (26)
URUGUAY
Maldonado
Maldonado, 3454/5457 sea level (19)
San José
Arazatí, S. Ecilda, 3433/5657 sea level (20)

Field Museum small mammal surveys in Brazil, 1986—1992

Our study of the small mammals of southcentral and southeastern Brazil began with live trapping in the *campos cerrados* of Brasília, D. F., during July—August 1986. The prime objective at the time was the capture of the fossorial sigmodontine rodent *Juscelinomys candango* Moojen, 1965. The species is known from the original series of 8 specimens, including holotype, taken from a *cerrado* subterranean system in the Parque Nacional de Brasília. The live animal has never been seen again. Our intensive trapping at ground level, and excavations of burrows proved fruitless. Nevertheless, a collection of about 150 rodents of 15 genera resulted from our search. Most of the material is still under study. The reports published to date include the description of a new species of *Thalpomys* (Hershkovitz 1990a), a new species of *Akodon* (Hershkovitz 1990b) and a new genus *Microakodontomys* and its type species, *M. transitionalis* (Hershkovitz 1993).

Official permits for work in the Parque Nacional de Brasília and cerrado (fig. 2) were granted through the sponsorship of Professor Ulises Caramaschi of the Museu Nacional. The then graduate assistant of the mammal department, Christopher Tribe, was assigned to the project. Others who assisted with field work, material support, hospitality and in many other ways, included Professor Jader Soares Marinho Filho, and Professor Milton Thiago de Mello, both of the Universidade de Brasília, Alberto de Paulo Carlos, of IBAMA (Instituto Brazileiro do Meio Ambiente e de Recursos Naturais Renováveis), Miguel Angelo Marini, a student, and Dr. Braulio F. de Sousa Dias of the Brazilian Geographic Institute.

Scott Lindbergh, an American resident in Brasília D. F., who was studying the behavior of the *cerrado* howler monkey, *Alouatta fusca*, volunteered his services without conditions. Scott's devoted and generous assistance throughout the entire field program accounts for much of the success of our field work here and elsewhere in eastern Brazil.

Fig. 2: Views of Parque Nacional de Brasília, Brazília, D.F.

The Primate Center of Rio de Janeiro about 60 km N of the city, with small remnants of Atlantic rain forest was visited October—November, 1987, for sampling its small mammals. About 120 specimens were collected but the unidentified material has not been released by our then Brazilian sponsor and field associate, Professor Jader Soares Marinho Filho. Field work was facilitated by the Center's Manager, Lourenço, and by the dedicated assistance of Professor Jader Marinho, his student Marcelo Lima Reis, and Field Museum Associate Barbara E. Brown. I am particularly grateful to the then Director of the Center, Dr. Adelmar Coimbra-Filho for his deep interest in our labors and unstinting cooperation.

The Rio de Janeiro State Park at Teresópolis, was worked July—August 1988. Our Brazilian sponsor was again Professor Jader Marinho. The approximately 125 specimens collected still remain in his care and have not been made available for study.

Field assistants included Jader Marinho Filho, Marcelo Lima Reis, and our Barbara Brown.

The São Paulo State Park Petar, Municipio Iporanga (fig. 3), engaged our survey efforts November—December, 1989. The approximately 220 specimens distributed in about 20 genera were delivered to the Zoology Museum of the University of São Paulo, for processing. The entire collection is now being studied in the Field Museum. Dr. Paulo E. Vanzolini, Director of the Museu de Zoologia, Universidade de São Paulo, was our sponsor.

Fig. 3: Four views of Parque Estadual Petar, Iporanga, São Paulo.

The Parque Nacional de Caparaó (figs 4, 5), with an area of 16,194 hectares, straddles the comparatively dry part of western Minas Gerais and the humid eastern or Atlantic slope of Espírito Santo. The Park, between 20°19'—20°37'S, 41°43'—42°53'W (fig. 1) was established May, 1961 by Federal decree, far too late to prevent virtually complete destruction of the original forest cover.

The Serra do Caparaó at the northernmost edge of the Serra do Mar is rugged mountain country with elevations from about 800 m to the Pico da Bandeira at 2890 m. The terrain is broken by many steep valleys and waterfalls. The vegetation in 1981 was described as tropical rain forest to about 1800 m then open grassland above 2400 m. In 1989 the flora was described by IBAMA as almost entirely secondary, considerably degraded, with no resemblance to the original formations. The vegetation had become increasingly poorer at higher altitudes, with dominance of epiphytes, mosses and lichens. The mammalian fauna, according to IBAMA, was reduced to such widespread species as the rabbit, agouti, squirrel, and small predators including eira cat, fox, racoon and coati.

Review of the Ruschi (1978) and Blair (1989) reports on the mammals of the Parque Nacional de Caparaó

The recent mammals of the Parque Nacional de Caparaó are known from two comprehensive reports. The first, by Ruschi (1978) appears to be a collection of

Fig. 4: Views of Parque Nacional de Caparaó, Minas Gerais.

scattered data of mostly personal observations gathered over a period of 40 years. The second, by Blair (1989) is from her unpublished doctoral thesis based on 18 consecutive months of field work. Each report lacks documentation for specimens collected and most of the identifications must be taken at face value. Nonetheless, their reports are the most comprehensive available in terms of the mammals of the region.

The Ruschi account

The late Augusto Ruschi, a long time resident of Santa Teresa, Espírito Santo, observed the birds and mammals, particularly hummingbirds and bats, of the Caparaó mountains for over 40 years. His (1978) report lists 74 species of mammals, 251 species of birds, and a detailed account of the vegetation and life zones of the Parque Nacional de Caparaó. The account includes names of authors with bibliographic references to original descriptions, and scientific and vernacular names of the species. A bat of the genus *Tadarida* was described.

Ruschi (p. 26) emphasized the fact that survival of the woolly spider monkey (*Brachyteles arachnoides*) in the Park was threatened (none survived) and that the lion tamarin, *Leontopithecus rosalia chrysomelas* disappeared from Espírito Santo in 1978, most of its habitat having been converted to charcoal. He predicted early extinction of the endemic mouse *Abrawayomys* from the nearby Forno Grande Biological Reserve.

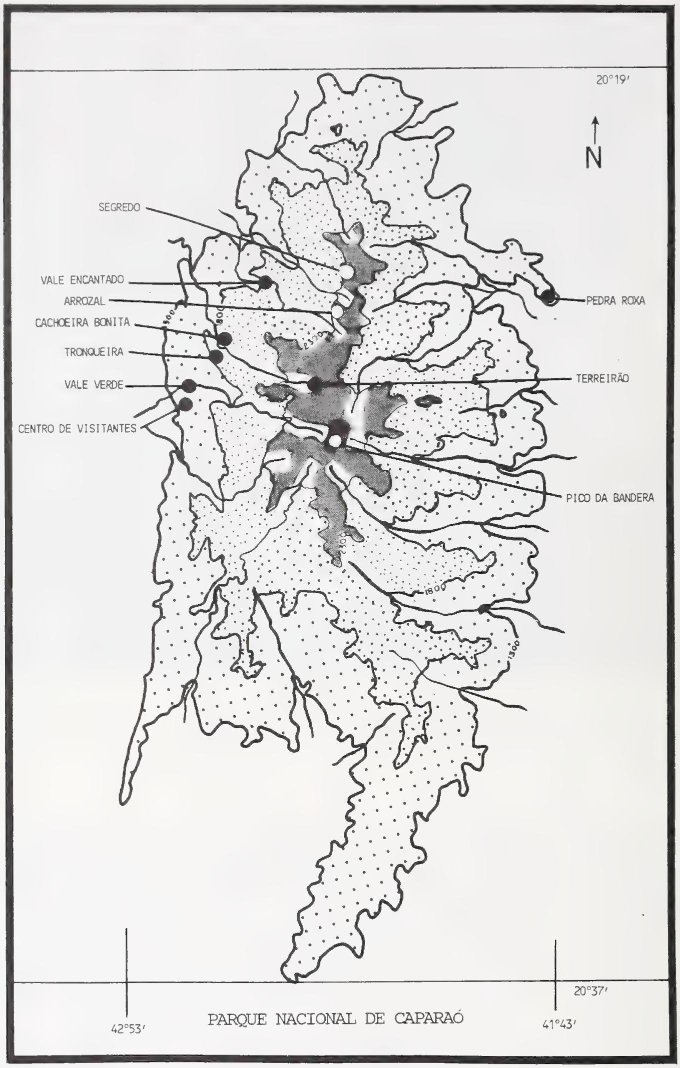


Fig. 5: Map, Parque Nacional de Caparaó, Minas Gerais — Espírito Santo; collecting stations shown are on the Minas Gerais (western) slope, except Pedra Roxa in the Espírito Santo (eastern) watershed.

The "Museu de Biologia Prof. Mello Leitao," issuer of Ruschi's publications, housed no mammals and its *Boletim*, like the Museum, was the property of Dr. Ruschi. He listed the following Caparaó mammals in 1978. Voucher specimens may not exist but the identifications are presumed to be reliable. Nominal equivalents as used in *Mammal Species of the World* follow in brackets, the subspecies suppressed by the compilers. The work was edited by Wilson and Reeder (1993).

MARSUPIALIA
- Didelphidae
  - *Didelphis marsupialis* Linnaeus
  - *Didelphis aurita* Wied-Neuwied
  - *Metachirus nudicaudatus myosurus* Temminck [*Metachirus nudicaudatus* É. Geoffroy]
  - *Philander philander philander* [*Caluromys philander* Linnaeus]
  - *Chironectes minimus* Zimmermann
  - *Monodelphis scalops* Thomas
  - *Monodelphis iheringii* Thomas [*Monodelphis iheringi* Thomas]
  - *Marmosa cinerea cinerea* Temminck 1824 [*Micoureus demerarae* Thomas; *cinerea* Temminck preoccupied by *D. cinerea* Goldfuss, 1812]

CHIROPTERA
- Molossidae
  - *Molossus ater* E. Geoffroy
  - *Eumops auripendulus* Shaw
  - *Tadarida espiritosantensis* Ruschi ["probably a synonym of *Nyctinomops laticaudatus*," Koopman, 1993: 240]
- Phyllostomidae
  - *Phyllostomus hastatus* Pallas
  - *Chrotopterus auritus australis* [*Chrotopterus auritus* Peters]
  - *Mimon bennetti* Gray
  - *Micronycteris megalotis* Gray
  - *Glossophaga soricina* Pallas
  - *Artibeus jamaicensis planirostris* Spix [*Artibeus planirostris* Spix]
- Desmodontidae [Desmodontinae subfamily of Phyllostomidae]
  - *Desmodus rotundus* É. Geoffroy
  - *Diphylla ecaudata* Spix
- Vespertilionidae
  - *Myotis nigricans* Schinz
  - *Lasiurus ega argentinus* Thomas [*Lasiurus ega* Gervais]

PRIMATES
  - *Callicebus gigot* [*Callicebus personatus* É. Geoffroy]
  - *Alouatta fusca* É. Geoffroy
  - *Cebus nigritus* Goldfuss [*Cebus apella* Linnaeus]
  - *Brachyteles arachnoides* É. Geoffroy
  - *Callithrix aurita caelestis* Miranda Ribiero [*Callithrix aurita* É. Geoffroy]
  - *Callithrix flaviceps* Thomas

EDENTATA
  - *Tamandua tetradactyla* Linnaeus
  - *Bradypus tridactylus brasiliensis* Blainville [*Bradypus variegatus* Schinz]
  - *Euphractus sexcinctus flavimanus* Desmarest [*Euphractus sexcinctus* Linnaeus]
  - *Dasypus novemcinctus* Linnaeus

LAGOMORPHA
  - *Sylvilagus brasiliensis minensis* Thomas [*Sylvilagus brasiliensis* Linnaeus]

RODENTIA
  - *Sciurus ingrami* Thomas [*Sciurus aestuans* Linnaeus]
  - *Thomasomys pyrrhorhinus* Wied Neuwied [*Wiedomys pyrrhorhinus* Wied-Neuwied]
  - *Thomasomys dorsalis collinus* Thomas [*Delomys dorsalis* Hensel]
  - *Thomasomys sublineatus* Thomas [*Delomys sublineatus* Thomas]
  - *Nectomys squamipes olivaceus* Hershkovitz [*Nectomys squamipes* Brants]
  - *Rhipidomys masticalis* Lund
  - *Phaenomys ferrugineus* Thomas
  - *Akodon arviculoides cursor* Winge [*Akodon cursor* Winge]
  - *Akodon subterraneus* Hensel [*Thaptomys nigrita* Lichtenstein]

Oxymycterus nasutus Waterhouse
Blarinomys breviceps Winge
Coendou prehensilis Linnaeus
Cavia aperea azarae Lichtenstein [*Cavia aperea* Erxleben]
Dasyprocta aguti Linnaeus
Cuniculus paca Linnaeus [*Agouti paca* Linnaeus]
Euryzygomatomys guiara Brandt [*Euryzygomatomys spinosus*]
Echimys medius Thomas [*Echimys blainvillei* F. Cuvier]

CARNIVORA
Dusicyon vetulus Lund [*Pseudalopex vetulus* Lund]
Dusicyon thous azarae Wied Neuwied [*Cerdocyon thous* Linnaeus]
Procyon cancrivorus nigripes Mivart [*Procyon cancrivorus* G. Cuvier]
Nasua nasua nasua Linnaeus [*Nasua nasua* Linnaeus]
Nasua nasua solitaria Schinz [*Nasua nasua* Linnaeus]
Potos flavus nocturnus Wied Neuwied [*Potos flavus* Schreber]
Tayra barbara gulina Schinz [*Eira barbara* Linnaeus]
Grison furax Thomas [*Galictis cuya* Molina]
Panthera onca Linnaeus
Puma concolor greeni Nelson & Goldman [*Puma concolor* Linnaeus]
Felis pardalis brasiliensis Oken [*Leopardus pardalis* Linnaeus]
Felis wiedii Schinz [*Leopardus wiedi*]
Felis yaguarondi Lacépède [*Herpailurus yaguarondi* É. Geoffroy]
Felis pardinoides Gray [*Leopardus tigrinus* Schreber]

PERISSODACTYLA
Tapirus terrestris Linnaeus

ARTIODACTYLA
Tayassu pecari Link
Tayassu tajacu Linnaeus [*Pecari tajacu* Linnaeus]
Mazama americana Erxleben
Mazama simplicicornis Illiger [*Mazama gouazoupira* G. Fischer]

Remarks. Most of the species recorded by Ruschi may still be found on the Espírito Santo slope. The list of bats may be longer. Also present are the rabbit, squirrel, and more kinds of sigmodontine rodents. Some of the carnivores may have been extirpated. The once abundant tapir, deer, peccaries and most if not all monkeys may have disappeared.

The Blair Report 1979—1980

Blair recorded 53 species captured or observed in the Caparaó National Park from May 1979 through October 1980.

The small mammals were live trapped, sexed, marked, measured and released. Trap lines were along transects, hence not selective for species diversity. Bats were caught in mist nets. Carnivores were identified by recovered feces or pellets, burrows, tracks, sight or other external signs. Identifications of captured animals were based on their external measurements compared with those of previously identified specimens preserved in museums or recorded in the literature. Characters other than standard external dimensions taken from the anesthetized captives were not used in the identifications. The identification of feces by size and shape could be problematic. Authorities for generic and specific names were systematically eschewed.

None of the animals recorded were preserved for confirmation of their identifications and they are listed as recorded. Sight records are bracketed.

MARSUPIALIA
- *Didelphis marsupialis*
- *Metachirops opossum*
- *Marmosa cinerea*
- *Marmosa murina*
- *Marmosa* sp. 3

EDENTATA
- *Cabassous tatouay*
- *Dasypus novemcinctus*
- *Dasypus septemcinctus*
- *Euphractus sexcinctus*
- *Myrmecophaga tridactyla*

PRIMATES
- *Cebus apella*
- *Callicebus moloch*

CHIROPTERA
- *Carollia perspicillata*
- *Desmodus rotundus*
- *Glossophaga soricina*
- *Histiotus velatus*
- *Phyllostomus hastatus*
- Stenodermatinae sp. indet. (bones from owl pellets)
- *Sturnira* sp.
- *Uroderma bilobatum*
- *Vampyrops [= Platyrrhinus] lineatus*
- *Vampyressa pusilla*

RODENTIA
- *Akodon arviculoides*
- *Akodon cursor*
- *Akodon serrensis*
- *Blarinomys breviceps*
- *Nectomys squamipes*
- *Oryzomys bicolor*
- *Oryzomys capito*
- *Oryzomys concolor*
- *Oryzomys eliurus*
- *Oryzomys flavescens*
- *Oryzomys fornesi*
- *Oryzomys intermedius*
- *Oryzomys nigripes*
- *Oryzomys nitidus*
- *Oryzomys ratticeps*
- *Oxymycterus hispidus*
- *Thaptomys nigrita*
- *Sciurus ingrami*
- *Thomasomys dorsalis*
- *Thomasomys* [= *Wilfredomys*] *oenax* (bones from owl pellets)
- Unknown species: "Red mouse," diurnal; in grassland at 2500 m; long-tailed
- *Cavia aperea*
- *Coendou prehensilis*
- *Dasyprocta agouti*
- *Echimys medius*

CARNIVORA
- *Nasua nasua*

Procyon cancrivorus
[*Pseudolopex gymnocercus*]
[*Cerdocyon thous*]
Chrysocyon brachyurus
[*Lycalopex vetulus*]
Galictis vittata
Eira barbara
Felis [*Leopardus*] *wiedi/tigrinus*
Felis [*Herpailurus*] *yagouaroundi*
Felis [*Leopardus*] *pardalis*
Felis [Puma] *concolor*

ARTIODACTYLA
Tayassuidae sp. indet.

LAGOMORPHA
Sylvilagus brasiliensis

Field Museum-Museu Nacional joint survey of small mammals of the Parque Nacional de Caparaó, 1992

The Parque Nacional de Caparaó expedition promoted by the Field Museum and sponsored by the Museu Nacional, surveyed the small mammals, particularly the Sigmodontinae, September—October 1992. Participants in field work included Dr. Alfredo Langguth, Curator of Mammals of the Museu Nacional, our official sponsor for the field work, and his two assistants, Stella M. France and Allison A. Sodre.

The Field Museum was represented by the author and Associate Barbara E. Brown. Other participants included parasitologist Dr. Pedro Marcos Linardi of the University of Minas Gerais who focused on the ectoparasites of the captured mammals; Cibele Bonvecino, graduate student of the Universidade Federal de Rio de Janeiro, assisted actively in field work, her primary concern, however, being the cytogenetics of captured rodents. IBAMA representative Alberto de Paulo lent considerable field support. The indispensable Field Museum Associate Scott Morrow Lindbergh assured the success of the expedition with his keenly directed and indefatigable labors.

The Park Director José Olimpo Vargas provided housing. The Assistant Director Estevão Marchesini Fonseca helped with our installation, and facilitated our operations in many ways during the entire stay.

The Field Museum-Museu Nacional survey of the mammals of the Parque Nacional de Caparaó resulted in the capture and preservation of approximately 427 small mammals. Represented are 31 species distributed among the 21 genera listed below (number of species in each genus shown in parentheses).

Marmosa Gray (1)
Marmosops Matschie (1)
Micoureus Lesson (2)
Monodelphis Burnett (1)
Philander Tiedemann (1)
Didelphis Linnaeus (1)
Carollia Gray (1)
Desmodus Wied (1)

Glossophaga É. Geoffroy (1)
Akodon Meyen (3 including 1 new)
Thaptomys Thomas (1)
Brucepattersonius (new genus; 4 all new)
Oxymycterus Waterhouse (2 including 1 new)
Calomys Waterhouse (1)
Oryzomys Baird (2)
Oligoryzomys Bangs (3)
Nectomys Peters (1)
Delomys Thomas (2)
Proechimys J. A. Allen (1)
Euryzygomatomys Goeldi (1)
Cavia Pallas (1)

Results of the study of all the material collected in Caparaó, Iporanga and other localities of the region are being prepared for publication. The taxa included in this first report are the following.

Delomys Thomas
- *D. dorsalis* Hensel
- *D. sublineatus* Thomas

Akodon Meyen
- *A. serrensis* Thomas
- *A. cursor* Winge
- *A. mystax* (new species)

Thaptomys Thomas
- *T. nigrita* Lichtenstein

Brucepattersonius (new genus)
- *B. soricinus* new species and type species
- *B. igniventris* (new species)
- *B. griserufescens* (new species)
- *B. albinasus* (new species)
- *B. iheringi* Thomas
- *B.* sp. (from Misiones, Argentina, the *"Oxymycterus iheringi"* of Massoia [1963], not Thomas)

Oxymycterus Waterhouse
- *O. rufus* Fischer
- *O. caparaoe* (new species)

No large mammals other than the opossum (*Didelphis*) and coati (*Nasua*) were seen during our short visit. Signs of other predators were absent. Bats were not seen in flight at night but bad weather hindered observation and, except for the most common species, were not located during the day in apparently suitable roosts. The Ruschi and Blair reports present a picture of a rich mammalian fauna.

Species accounts

Abbreviations used include: BM = British Museum (Natural History), London; FM = Field Museum, Chicago; MN = Museu Nacional de Brazil, Rio de Janeiro; MZUSP = Museu de Zoologia, Universidade de São Paulo, São Paulo; PH = field numbers from 1992 surveys of Caparaó; E = Ear pinna from notch; GSL = Greatest skull length; HB = Length of head and body combined; HF = Hind foot length with claw (cu); without claw (su); T = Tail length.

Delomys Thomas

Delomys Thomas. Type species *Hesperomys dorsalis* Hensel, 1872, by original designation.

The genus has been revised by Voss (1993) with most of the taxonomic problems resolved. Of the two recognized species 72 specimens of *Delomys dorsalis* and 46 of *D. sublineatus* were examined by Voss. The new material studied here, most not seen by Voss, consists of 88 specimens with the registry numbers of the Museu de Zoologia, University of São Paulo, the Museu Nacional, Rio de Janeiro, and the Field Museum. Included are 72 specimens of *Delomys dorsalis* from 12 localities, and 15 specimens of *D. sublineatus* from 5 localities, all listed beyond under specimens examined, their localities plotted in figure 1 (map). The new material provided a basis for review of parts of Voss's findings.

Characters. *Delomys* is a medium sized sigmodontine; tail from slightly longer (105 %) than combined head and body length (HB) to shorter (75 %); hind foot long, narrow, length with claw 20 % to 25 % HB; ear large, length from notch about 15 % to 16 % HB; condylobasal length of skull about 20 % to 25 % HB, or approximately the same proportion as hind foot length with claw; mammae, 2 inguinal, 2 abdominal, 2 postaxial, and occasionally 2 pectoral = 6 or 8.

Coloration of upperparts dark brown (dominantly eumelanin) to buffy (dominantly pheomelanin), underparts dominantly grayish (dilute eumelanin); a more or less defined dark brown middorsal stripe nearly always present.

Dorsal contour of skull slightly convex; rostrum elongate; distal part of nasals and premaxillae combined usually project as a tube beyond incisors, the cartilaginous median septum (often lost in preparation) between nasal tips produced slightly beyond in expanded form; interorbital region more or less hourglass shaped, the supraorbital margins posteriorly rounded, square or frequently beaded, the beading continued behind as lateral parietal ridges; zygomatic arches moderately expanded with slight anterior convergence; perpendicular zygomatic plate visible viewed from above; interparietal bone well developed; incisive foramina comparatively short, not extending to level of first molars; palatal bridge short, wide, without conspicuous posterolateral pits, the posterior border not produced behind level of third molars; stapedial and sphenofrontal foramina present, squamosal-alisphenoid groove more or less defined; mandible with capsular tip of incisor root little or not pronounced.

Upper incisors small, inclination orthodont to opisthodont; molars brachyodont, pentalophodont, tuberculate, m_1 with well developed ectolophid.

Pentalophodonty or fusion of the mesostyle (–id) with the mesoloph (–id), in all molars to form the mesolophostyle (–id), is the one and only consistent and definitive character of thomasomyines (*Delomys* included) and oryzomyines that distinguishes them from all other sigmodontines. Muroid molars with a mesostyle (–id) discrete or absent in any tooth, or with a mesoloph (–id) discrete or absent in any tooth, are not pentalophodont. Disjunction between mesostyle (–id) and mesoloph (–id) with reduction and ultimate loss of either or both elements in any tooth of a dental system marks the irreversible transition from pentalophodonty to tetralophodonty (cf. Hershkovitz 1993).

Generic Relationships. In 1962, I (p. 21) suggested that *Thomasomys*, with a complex glans penis and a simple chambered stomach, must be much like the ancestral morphotype which could have given rise to the South American cricetines. The thomasomyine lineage, in my opinion at the time, included *Thomasomys, Nyctomys, Otonyctomys, Phaenomys, Rhipidomys,* and *Wilfredomys*. Elsewhere in the account (1962: 84, footnote 3), *Aepeomys, Inomys, Delomys* and *Erioryzomys* were referred to the *thomasomyine* group. It was cautioned, however (1966: 12, footnote), that "some characters shared by members of the group might be phenetic rather than phyletic." Subsequent removal of *Nyctomys* and *Otonyctomys* proved this point. With passage of time and increase in knowledge, more modifications were made.

The phylogenetic position of *Delomys* was analyzed by Voss (1993: 21) on the basis of morphological comparisons with *Thomasomys* and *Oryzomys*. *Thomasomys*, with 25 or more

species (Musser & Carleton 1993: 749), was represented in the comparisons by its type species, *T. cinereus*. *Oryzomys*, with 36 species (Musser & Carleton 1993: 712), was represented by the type species, *Oryzomys palustris*, a highly derived if not the most derived species, of the genus.

The eighteen characters used by Voss for comparison of *Delomys dorsalis* and *D. sublineatus* with *Thomasomys cinereus* and *Oryzomys palustris* are briefly discussed below. Numbers 19, 20 and 21 are additional sigmodontine characters mentioned separately by Voss (1993: 9, 12). Comparisons of the characters of type species of *Delomys* and *Thomasomys* are given in table 1, their nipples in table 2; measurements of *Delomys dorsalis* are in table 3, and of *D. sublineatus* and *D. dorsalis* in table 4.

1. Ungual tufts. Present in all four morphotypes (*Delomys dorsalis, D. sublineatus, Thomasomys cinereus, Oryzomys palustris*). Starting from a hypothetical primitive state of barely covering the claws, the tufts become hypertrophied in *Delomys* and *Thomasomys cinereus*. In *Oryzomys palustris*, they evolved in a negative direction to the point of near disappearance.

2. Plantar pads. The state of the 6 plantar pads (two metatarsal and four interdigital) is regarded as primitive in *Delomys* and *Thomasomys*. The system of 5 plantar pads in *Oryzomys* appears to be derived.

3. Mammae. The primitive number of paired teats or nipples in sigmodontines is 3. The paired formula in mammals developed pari passu from inguinal to abdominal and postaxial as in *Thomasomys* and nearly all Delomys. A pectoral pair became a fixture in oryzomyines, phyllotines and others, but in *Delomys* only as an infrequent variable (table 2). Voss's (1993: 13, 30) interpretation of the comparative morphology appears to be correct.

4. Rostral tube. This highly variable character ranges in *Delomys* from slightly protruded to extremely so but no more than in certain related species (i. e., *Thomasomys cinereiventer*). The rostral tube said to be absent in *Thomasomys cinereus* is actually more than incipient.

5. Zygomatic notch and zygomatic plate. Definition of the zygomatic notch depends largely on the form of the plate. In some *Delomys* (MN 31961, 31965) the notch may be as "indistinct" as illustrated by Voss (1993, fig. 5B) for *Thomasomys*, but in some *Thomasomys*, the notch may be nearly as "distinct" as illustrated by Voss (1993, fig. 5A) for *Delomys*. Definition of the notch in *Thomasomys* and *Delomys* is likewise a continuum beginning with the less derived state in *Thomasomys*.

6. Interorbital region and temporal crests. The hourglass shape as described and figured by Voss (1993: 15, fig. 6) for *Delomys* and *Thomasomys* holds. The posterior half of the supraorbital margin, however, is described as smoothly rounded, or sometimes gently squared but with sharp edges, beads, or projecting shelves never developed. This is said to be "the plesiomorphic condition." It does not hold, however, for nearly all specimens at hand of *Delomys* and *Thomasomys cinereus*.

7. Palate. The palate of *Delomys* and *Thomasomys* is correctly defined as short, that is with posterior margin not produced behind the third molars. It is seen as "probably plesiomorphic." According to Voss (1993: 15) "the bony palate of *Delomys* is short because the mesopterygoid fossa extends anteriorly between the third molars." The mesopterygoid fossa, a feature without definition in itself, does not form the palate or fashion its margin. It is, on the contrary, defined by the bony palate.

8. Mesopterygoid fossa and sphenopalatine vacuities. The sphenopalatine vacuities, slits or fenestrations of the bony roof of the mesopterygoid fossa vary in *Delomys* from nearly completely ossified, as depicted by Voss (1993, fig. 7 B) for *Thomasomys*, to 2 and 3 times the size shown for *Delomys* in his fig. 7 A. The roof of the mesopterygoid fossa in *Thomasomys cinereus* is ossified with few minute exceptions in the 30 specimens examined here. The unfenestrated or completely ossified roof may not be primitive. Ossification is an ongoing developmental process but need not be complete in any one structure.

9. Alisphenoid strut. The strut, absent in *Delomys* but present in *Thomasomys cinereus*, may be the most trenchant character for separation of the two genera.

Table 1: Comparisons of *Delomys* and *Thomasomys* based on their type species *Delomys dorsalis* Hensel and *Thomasomys cinereus* Thomas. *Thomasomys cinereiventer* J. A. Allen included for comparison.

Character	A *Delomys*	B *Thomasomys*	C *cinereiventer*
1. Mammae	2. 3 or 4 pairs	1. 3 pairs	1. As in B
2. Tail length	2. From 75 % as long as head and body combined to 5 % longer; average about equal.	2. Always longer	2. As in B
3. Blackish middorsal stripe	3. Always present, usually well defined	3. Absent	3. As in A, but broader, diffuse
4. Bevel of posterior surface of lower incisors	4. 60–70 % from tip	4. 40–60 % from tip	4. As in B
5. Bevel of posterior surface of upper incisors	5. 50–75 % from tip	5. Nearly to or quite to alveoli	5. As in A
6. Zygomatic plate	6. Forward projecting, anteorbital foramen (notch) well exposed seen from above	6. Hardly or not forward projecting, foramen slightly or not exposed seen from above	6. As in A
7. Nasals with premaxillae	7. Usually extended as a tube	7. Tips of nasals usually on same vertical plane as incisors, sometimes slightly anteriad	7. As in A
8. Supraorbital beads or ridges	8. Partially present	8. Absent	8. As in A
9. Temporal ridges	9. Present but weak	9. Variable	9. Absent[1]
10. Nasals	10. Tapered to obtuse point	10. Slightly expanded to rounded tip	10. As in A
11. Zygomatic arches anteriorly	11. Slightly convergent	11. Expanded or rounded	11. As in A
12. Frontoparietal suture	12. Widely rounded	12. Narrowly rounded	12. As in A
13. Incisive foramina	13. Subovate, about as open in front as behind	13. Narrower in front than behind	13. As in A
14. Ascending mandibular ramus	14. Wide, nearly square	14. Narrow, rectangular	14. As in B
15. Coronoid process	15. Short, as spine	15. Elongate, as process	15. As in B
16. Sigmoid notch	16. Short, rounded, deep	16. Long, shallow	16. As in B
17. Molars	17. Large, long	17. Smaller, shorter	17. As in B
18. Upper incisors	18. Opisthodont to orthodont	18. Mostly orthodont	18. As in B
19. Lower incisors	19. Fine, short	19. Heavier, longer	19. As in B
20. Capsule of upper incisor root	20. Not bulging	20. Bulging	20. As in A
21. Capsular process of lower incisor	21. Slightly or not indicated	21. Slightly pronounced	21. As in B
22. Entepicondylar foramen	22. Absent	22. Not available	22. Not available
23. Articulation of rib 1	23. With thoracic 1st, or cervical 7th and thoracic 1st	23. Not available	23. Not available
24. Alisphenoid strut	24. Absent	24. Present	24. Present
25. Ectolophid	25. Present	25. Absent	25. Absent

[1] weakly developed in old individuals

10. Carotid circulation. Present as described in *Delomys* and *Thomasomys cinereus*. Pattern 1 of Voss (1993: 18, 24) appears to be primitive.

11. Tegmen tympani. This outgrowth of the periotic bone overlies the squamosal bone in *Delomys* and *Thomasomys* as stated. It also may merely contact the squamosal bone, and in a few samples is separated from it. Overlapping is said to be primitive but perhaps is an advanced stage of a relationship between bones.

12. Capsular process. A minute point marking the tip of the lower incisor root in the mandible is present in *Delomys* and most *Thomasomys cinereus*, but may be slightly swollen in individuals. It appears that the more pronounced the capsular process, the more derived.

13. Incisors. Judgement of the amount of inclination of the upper incisor is largely subjective. Voss (1993: 24, fig. 5, A, B) figures and describes the *Delomys* incisor as "small and strongly opisthodont," that of *Thomasomys* as "large and weakly opisthodont". In material at hand, most incisors of *Delomys* are weakly opisthodont to moderately orthodont. In my view those of *Thomasomys cinereus* are mostly orthodont with a few weakly opisthodont. Most *Delomys* incisors are smaller than those of *Thomasomys*. The weakly opisthodont incisor may be the more primitive.

14. Molar occlusal design. The unworn molars of *Delomys* and *Thomasomys* may be described as basically brachyodont, pentalophodont, tuberculate, and crested bilevel. Every stage of wear causes a change in molar crown design. The lophs of the molar crowns of *Delomys* and *Thomasomys cinereus* (Voss 1993: figs 9, 10) are the well defined lophs of the pentalophodont pattern. No consistent differences in designs of *Delomys* and *Thomasomys* molars exist except for presence of an accessory lophid in *Delomys* that is absent in *Thomasomys cinereus* (see item 16 below, and Hershkovitz 1962: 69 et. seq.).

15. Anterocone or anteromedian flexus. The feature is present in M^1 in both *Delomys* and *Thomasomys cinereus* as described by Voss (1993: 20, 24). Variability of the conules defined by the flexus is discussed in my description of *Delomy dorsalis* (p. [43 ms.]).

16. Ectolophid. The well developed loph between protoconid and hypoconid of m_1 in *Delomys* originates on the labial side of the mure and fuses with the ectostylid of the cingulum. An ectolophid is sometimes present in m_2. The ectolophid is absent in *Thomasomys cinereus* except for an anlage in some specimens. The ectostyle, however, is always present and well developed. It is difficult to judge within the limitations of this comparison whether the ectolophid is primitive or derived. Unlike the mesolophid on the opposite side of the mure, there are no signs of intermediate stages in the genera compared that might point to the direction of change.

17. Number of ribs. Thirteen ribs is the usual number in mammals including *Delomys* and *Thomasomys*. In many, if not most individuals, the number may vary from 12 to 14. The mode, therefore, is 13, one rib more or less may be regarded as within normal or primitive limits.

18. Gall bladder. A gall bladder was found by Voss (1993: 21) in all seven specimens examined of *Delomy dorsalis* but not in "a poorly fixed liver of the only available fluid example of *D. sublineatus*." It was present in the only two available specimens of *Thomasomys cinereus*.

19. Tuberculum of first rib. The articulation is with the transverse process of the seventh cervical vertebra also with first thoracic vertebra as stated by Voss (1993: 9). The number of specimens Voss examined was not given. In a specimen at hand of *Delomys sublineatus* (FM 149629) and another of *D. dorsalis* (MN 31935) the articulation is with thoracic only. In remaining 4 available skeletons of *D. dorsalis*, the articulations are with cervical 7 and thoracic 1.

20. Entepicondylar foramen. The foramen, which provides passage for the median nerve and brachial artery is absent in present material. According to Carleton (1980: 52) "the foramen may be absent in whole groups currently considered monophyletic, e. g., microtines and South American cricetines . . . Within the neotomine-peromyscines, the foramen is typically

Table 2: Number of nipples in the species of *Delomys*. Explanation: m6 = 3 pair nipples; m8 = 4 pair nipples (including pectorals).

Taxon	Localitiy	♂	♀	m6	m8
Delomys dorsalis	Caparaó	4	14	14	0
	Iporanga	7	5	3	2
	Teresópolis	0	2	0	2
	Boraceia	8	8	8	0
	Caraguatay	1	2	2	0
Delomys sublineatus	Teresópolis	4	1	1	0
	Iporanga	0	2	0	2

present." The supracochlear foramen, a perforate of the olecranon fossa, common in South American sigmodontines, may be confused with the entepicondylar foramen where the latter is normally absent.

21. Basihyal (basihyoid) without entoglossal process apud Voss (1993: 9). The few sigmodontine hyoids I examined lack an entoglossal process.

Habits and habitat. According to information compiled by Voss (1993), both *Delomys dorsalis* and *D. sublineatus* inhabit wet tropical and subtropical forest floors. His photographs of habitats suggest a preference for lush vegetation. Sympatric *D. dorsalis* and *D. sublineatus* were collected by our group in the humid secondary forests of Iporanga and Apiaí but also in open areas. Only *D. dorsalis* was taken on the dry slope of the Parque Nacional de Caparaó.

Delomys dorsalis Hensel (figs 6, 8, 9, tables 1—4)

Hesperomys dorsalis Hensel, 1872: 42, pl. II, figs 16a upper molar row, fig. 16b lower molar row, fig. 26b (m_2 enlargement from 16b).

Hesperomys dorsalis var. obscura Leche, 1886: 696. Brazil: Rio Grande do Sul (type locality, Taquara do Mundo Novo).

Akodon dorsalis lechei Trouessart, 1904: 434. New name for *Hesperomys dorsalis* obscura Leche, wrongly believed preoccupied by *Mus obscurus* Waterhouse 1834 (a *Necromys* [= *Bolomys*]).

Delomys dorsalis, Thomas, 1917: 196 — classification.

Delomys dorsalis collinus Thomas, 1917: 197 — Brazil: Rio de Janeiro (type locality, Itatiaya, 1800 feet; other specimens from Piquete and Alta da Sierra); holotype, adult male, skin and skull, BM 14.2.23.12.

Holotype. None specified; 7 paratypes collected by Reinhold Hensel include 5 in spirits, 1 skeleton, and 1 skull; the skeletal material and at least 1 spirit-preserved specimen were used in the original description.

The original description of *Delomys dorsalis* is based on the upper and lower molar rows (both figured), the incisors, and 2 skulls. Measurements of the larger of the skulls are basal length 25.5 mm, nasals 13.3 mm, incisive foramina 6.0 mm, interorbital width 5.3 mm; sagittal diameter of interparietal 4.0 mm, frontal 10.4 mm. Vertebral count is 13 thoracic, 6 lumbar, 32 caudal; 17th vertebra diaphragmatic. External measurements of a large spirit-preserved individual are head and body 135 mm, tail 124 mm, and hind foot 27 mm.

The upper and lower molar rows of *Hesperomys dorsalis* figured and described by Hensel (1872: pl. 2, figs 16a, 16b, 26b) are unambiguous representatives of the species and are hereby designated lectotype. The cotypes or paratypes were originally deposited in the Berlin Natural History Museum.

Type locality. State of Rio Grande do Sul, Brazil.

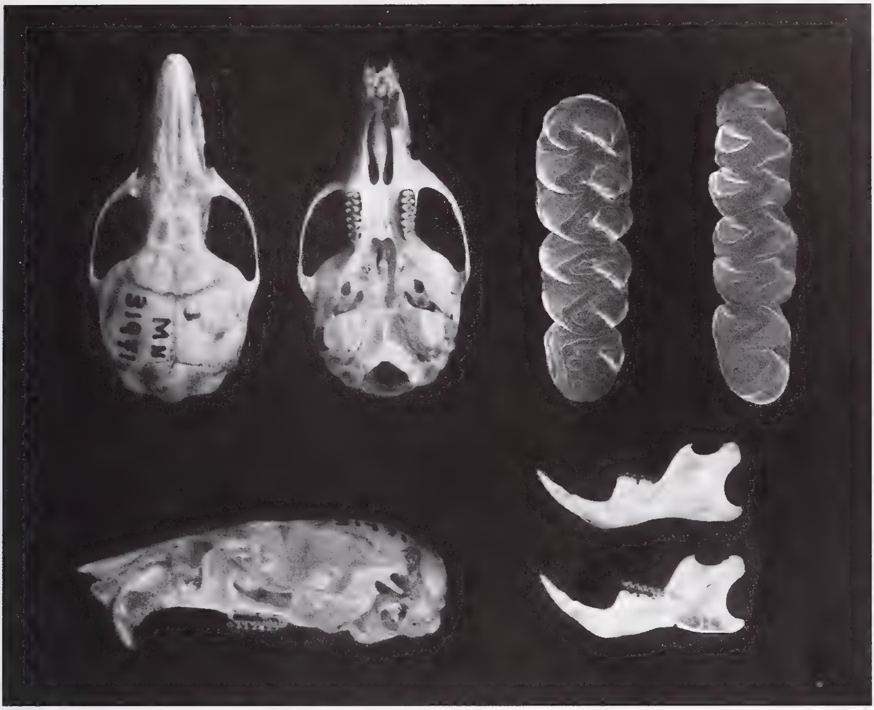


Fig. 6: *Delomys dorsalis* (MN 31971); skull and molars. GSL, 29.7 mm; molars, 4.8 mm.

Distribution. Southeastern Brazil, from Minas Gerais south through the states of Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul, and the province of Misiones, Argentina.

External characters. *Delomys dorsalis* is a medium sized, dark colored, medium to short-tailed, narrow-footed, large eared mouse characterized mainly by a more or less defined blackish middorsal stripe extending from crown or nape to rump or base of tail. Underparts are grayish with thin orange-colored wash, the slaty hair bases usually showing through; division between sides and underparts undefined or marked by a poorly defined, usually broken, orange line from cheeks to tail base. Tail length from about 82 % to 105 % of combined head and body length with average a little under 100 % (table 2); tail thinly pilose, the scales showing through, hair dark brown above, same beneath or with nearly entire ventral surface to one third or one half contrastingly paler; feet long, narrow, whitish above, the short hairs unbanded, the dark skin showing through; mystacial vibrissae usually long, when laid back most vibrissae extend beyond the ears; paired nipples are inguinal, abdominal and postaxial = 6, occasionally a pectoral pair is present to total 8 nipples.

Measurements. See table 3.

Karyotype. 2n = 82 (Zanchin et al. 1992).

Sexual dimorphism. None consistent.

Comparisons. The comparisons are between 67 specimens of *D. dorsalis* of which 49 are from Caparaó, 7 from Iporanga and Apiaí, 7 from Boraceia and 4 from Teresópolis, and 9 of sympatric specimens of *D. sublineatus* of which 4 are from Iporanga and 4 from Boraceia; and 1 from Teresópolis. Altogether a total of 73 specimens were examined.

Table 3: Measurements of *Delomys dorsalis* from Caparaó, Minas Gerais and Iporanga, São Paulo; measurements in mm are of means, extremes, followed by sample size.

Locality	Caparaó ♂	Caparaó ♀	Iporanga ♂	Iporanga ♀
HB[1]	132(111–150)25	128(111–138)20	142(133–158)5	144(135–154)6
Tail length	130(118–146)16	126(118–136)14	139(133–150)4	139(139–141)6
Hind foot[2]	30(26–33)26	30(28–35)24	31(29–32)4	30(29–31)6
Ear[3]	20(18–23)26	21(19–24)24	22(20–23)5	22(21–23)6
CL[4]	30.6(28.4–37.8)21	29.5(27.7–31.8)15	30.8(30.1–31.5)5	30.5(29.0–31.9)6
ZB[5]	16.5(14.4–17.6)21	16.5(15.6–17.1)15	16.7(16.4–17.2)5	16.6(16.3–16.9)6
IB[6]	5.2(5.0–5.5)21	5.2(4.9–5.5)16	5.3(5.2–5.3)5	5.1(5.0–5.2)6
BW[7]	13.8(12.8–14.4)21	13.9(13.1–14.6)15	13.9(13.6–14.3)5	13.9(13.5–14.2)6
NL[8]	13.8(12.7–15.6)21	13.5(12.4–14.4)16	13.8(12.8–15.0)5	13.9(12.3–14.2)6
IF[9]	7.2(6.6–7.5)21	6.9(6.4–7.5)16	7.3(6.8–7.7)5	6.7(6.6–7.0)6
PL[10]	5.3(4.8–5.8)21	5.2(4.7–5.8)16	5.2(4.9–5.3)5	4.9(4.7–5.1)6
UM[11]	5.0(4.8–5.3)21	4.9(4.6–5.2)16	4.9(4.8–5.0)5	4.7(4.6–4.8)6
D[12]	9.1(8.5–9.9)21	8.8(8.0–9.5)16	9.0(8.6–9.3)4	8.9(8.4–9.3)6
R[13]	6.0(5.4–6.5)21	5.8(5.5–6.0)16	6.4(5.9–6.9)4	6.1(5.6–6.4)5
W[14]	47(25–54)25	43(28–51)23	67(58–75)3	58(45–72)6
ZP[15]	3.0(2.8–3.3)21	3.0(2.6–3.5)16	3.0(2.9–3.1)5	2.9(2.5–3.1)6

[1] HB = Head and body; [2] with claw; [3] from notch; [4] CL = Condylobasal length; [5] ZB = Zygomatic breadth; [6] IB = Interorbital breadth; [7] BW = Braincase width; [8] NL = Nasal length; [9] IF = Incisive foramen; [10] PL = Palatal length; [11] UM = Upper molar row; [12] D = Diastema; [13] R = Rostral breadth; [14] W = Weight, grms; [15] ZP = Zygomatic plate.

Pelage of most *Delomys sublineatus* is shorter, coarser, and paler or ochraceous buff, the pheomelanin subterminal band wider. Pale individuals of the Caparaó series of *dorsalis* intergrade with the *sublineatus* from Boraceia.

The distinctive dark middorsal band is present in all *D. dorsalis*, albeit ill defined in many. A well-defined middorsal dark band is likewise present in all *D. sublineatus* from Teresópolis, Iporanga-Apiaí and in 4 of 5 from Boraceia.

The bright lateral line that marks the color separation of sides of body from underparts is nearly always present and well defined in *sublineatus*. It is often present in *D. dorsalis* but usually broken in parts where fur is shaggy. Ears uniformly dark brown in *dorsalis*, paler or partially unpigmented in *sublineatus*; tail always shorter in *sublineatus* (77 % to 92 %) than combined head and body length, and averages shorter than the proportional tail length of *dorsalis* (82 % to 105 %); mystacial vibrissae appear to be thinner and shorter in *sublineatus*, when laid back few extend beyond ears; whitish hairs of dorsal surface of hind feet are entirely unbanded in both species; in some, the darkly pigmented skin shows through giving a dusky appearance to the foot; tail dark brown, slightly paler beneath in some, partially bicolor in others more frequently in *sublineatus* but rarely entirely bicolor; length of outer pedal digits relative to adjacent ones similar in both species.

Cranial characters do not distinguish the species although individual and population differences may be noted (Voss 1993: 27) and a slightly greater size of *sublineatus* compared with sympatric *dorsalis* (Voss 1993: fig. 13). Among dental traits, the anterolabial conule of m^1 in *D. dorsalis* is said to be about the same size as the anterolingual conule. In *D. sublineatus*, however, it is said to be usually smaller. A tabulation of the comparative sizes of the right and left anteroconules in the Caparaó *D. dorsalis* revealed the left with 7 larger, 14 smaller, 10 about equal, 13 indeterminate. Whatever the variation of the anterior conules in *D. sublineatus*, no consistent difference from *D. dorsalis* can be proven. An enterolophid in m_1 is consistently present in both species.

Specimens examined: Total 73. ARGENTINA: Misiones (Caraguatay, FM 11); BRAZIL: Paraná (Roça Nova, 100 m, FM 1); Rio de Janeiro (Teresópolis, FM 2); São Paulo (Boraceia, FM 8; Iporanga, MZUSP 15); Minas Gerais, (Parque Nacional de Caparaó, Arrozal, 2300 m, MN 1; Cachoeira Bonita, 1750 m, MN 17; Pico da Bandeira, 2700 m, MN 2; Segredo,

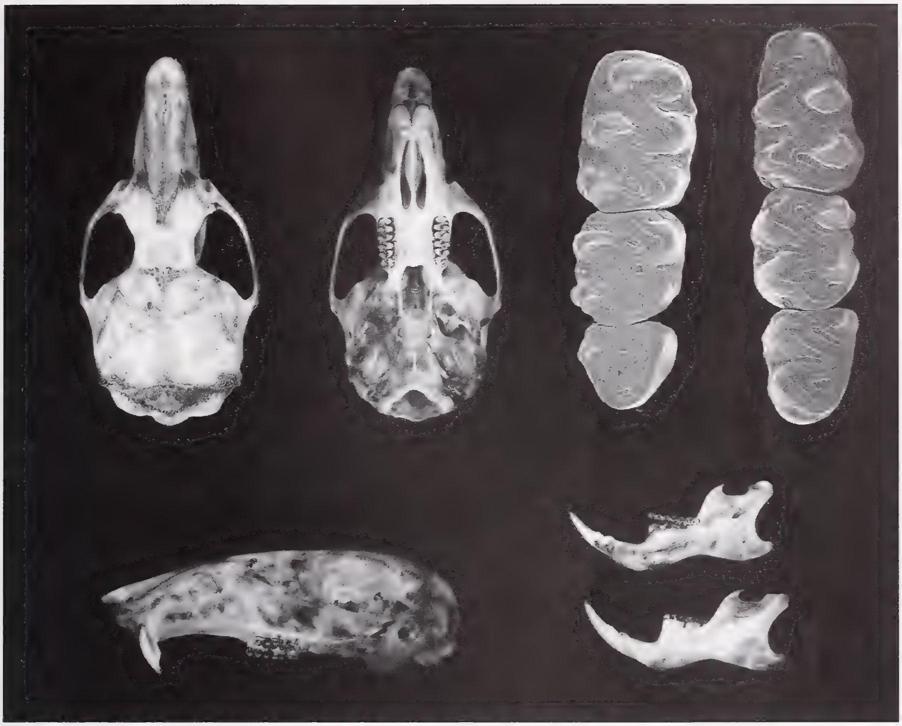


Fig. 7: *Delomys sublineatus* (PH 10080); skull and molars. GSL, 31.4 mm; molars, 4.8 mm.

2100 m, MN 6; Tronqueira, 1790 m, MN 1; Terreirão, 2400 m, MN 15; Vale Encantado, 2100 m, MN 5).

Delomys sublineatus Thomas (fig. 7, table 4)

Delomys sublineatus Thomas, 1903: 240.

Holotype. Old adult male, skin and skull, British Museum (Natural History) no. 3.9.4.58, collected 14 February 1903, by A. Robert, original number 1224.

Type locality. Engenheiro Reeve, Espírito Santo, Brazil, elevation between 400—600 m.

Distribution. Southeastern Brazil in the States of Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Santa Catarina and Paraná (Voss 1993: 31).

Characters. See comparisons with *D. dorsalis*.

Karyotype. 2n = 72, FN = 90 (Yonenaga 1975: 283).

Nomenclature. The history of the fossil cranium of a *Delomys* recovered by Lund from cave deposits near Lagoa Santa, Minas Gerais, and subsequently described as *Calomys plebejus* by Winge (1887) has been reviewed by Voss (1993: 32). Identification of *plebejus* as a *Delomys*, first made by Avila Pires (1960), was accepted without qualification by Voss. Equation of *plebejus* with *sublineatus*, however, was rejected. Voss (1993: 34) argued that "synonymizing *plebejus* Winge 1887 with *sublineatus* Thomas, 1903 would have the highly undesirable consequence of replacing a type specimen with many characters useful for species discrimination by another with none. Thus, although there is no evidence that the taxon

Table 4: Comparative measurements of *Delomys sublineatus* and *D. dorsalis*.

	sublineatus Iporanga ♂ ♀	*sublineatus* Teresópolis ♂ ♀	*dorsalis* Boraceia ♂ ♀	*dorsalis* Boraceia ♂ ♀
HB[1]	137(126−146)4	124, 124, 138	118(104−135)7	127(113−135)5
Tail length	116, 118	111, 112, 127	136(130−145)4	106(100−115)5
Hind foot[2]	29(28−30)4	29, 30, 31	30(28−31)7	27(25−30)5
Ear[3]	21(20−22)4	20	19(16−20)7	21(20−22)5
CL[4]	30.0(29.0−30.7)4	28.1, 30.3	29.7(28.2−31.0)7	27.9(27.3−28.8)5
ZB[5]	17.1(16.7−17.4)4	15.8, 15.9, 16.3	15.8(14.7−16.5)7	15.7(14.8−16.4)5
IB[6]	5.2(5.1−5.3)4	4.6, 4.9, 5.0	5.4(5.2−5.5)7	4.8(4.7−5.0)5
BW[7]	13.7(13.3−14.3)4	13.0, 13.4	13.7(13.4−13.9)7	12.8(12.6−13.2)5
NL[8]	13.3(13.0−13.7)4	12.5, 12.8, 13.1	13.2(12.7−13.8)6	12.4(11.5−13.5)5
IF[9]	6.6(6.4−6.8)4	6.0, 6.4, 7.1	7.3(6.6−8.1)7	6.4(6.1−6.9)5
PL[10]	4.7(4.3−5.1)4	5.1, 5.2, 5.2	5.0(4.6−5.5)7	5.0(4.7−5.2)5
UM[11]	4.6(4.4−4.7)4	4.5, 4.7, 4.8	4.9(4.7−5.1)7	4.5(4.3−4.7)5
D[12]	8.4(8.0−9.0)4	8.2(7.4−8.7)4	8.7(8.3−9.2)7	7.7(7.3−7.9)5
R[13]	6.1(5.8−6.5)4	6.2(5.6−6.6)4	6.0(5.8−6.2)7	6.0(5.4−6.5)5
W[14]	60(45−83)4	—	—	48.55
ZP[15]	2.9(2.7−3.2)4	2.7, 2.7, 3.2	2.8(2.6−3.1)7	2.8(2.6−3.0)5

[1] HB = Head and body; [2] with claw; [3] from notch; [4] CL = Condylobasal length; [5] ZB = Zygomatic breadth; [6] IB = Interorbital breadth; [7] BW = Braincase width; [8] NL = Nasal length; [9] IF = Incisive foramen; [10] PL = Palatal length; [11] UM = Upper molar row; [12] D = Diastema; [13] R = Rostral breadth; [14] W = Weight, grms; [15] ZP = Zygomatic plate.

represented by the Lagoa Santa fossil is extinct, no biological or nomenclatural purpose is served by synonymizing it with either of the Recent species recognized as valid in this report; *plebejus* is a *nomen dubium* that should be used only in reference to Winge's hypodigm."

Reasons given by Voss for rejection of the name *Calomys plebejus* Lund are personal opinions with justification.

Comparisons. See *Delomys dorsalis* account.

Measurements. See table 4.

Origin and dispersal. Phenetic similarity between *Delomys sublineatus* and *D. dorsalis* is such that specific distinction between the species is usually predicated on karyotypic differences and sympatry. At one time the two species were regarded conspecific, at another only subspecifically distinct. Zanchin et al. (1992: 168) who studied the karyotypes found "very few elements . . . shared by them. This mean[s] that not only centric fusions but pericentrimeric inversions and/or complex rearrangements are responsible for the different karyotypes." The rearrangements might have been responsible, among other characters of *sublineatus*, for the short, stiff pelage and selective reduction and partial elimination of the pheomelanin banding of the individual hairs of back and sides.

Specimens examined: Total 15. Rio de Janeiro (Fazenda Boa Fe, FM 1; Teresópolis, FM 4); São Paulo (Boraceia, FM 5; Cotia, FM 1; Iporanga, MZUSP 4).

Akodon Meyen

Akodon Meyen, 1833. Type species *Akodon boliviensis* Meyen, 1833: 600, pl. 43.

The three species of *Akodon* taken on the western slope of Mt. Caparaó are *A. cursor* Winge and *A. serrensis* Thomas, both members of the large-size *A. mollis* group, and a heretofore undescribed species of the small-size *A. boliviensis* group. The size

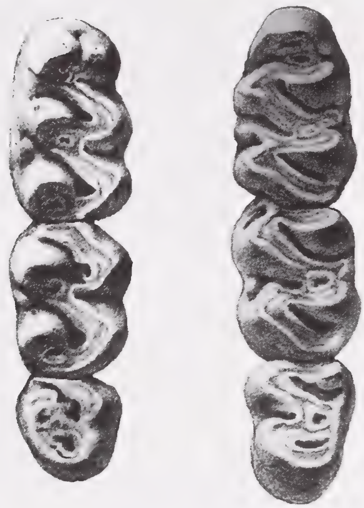


Fig. 8: *Delomys dorsalis* Hensel, 1872; upper molar row, 4.5 mm; lower, 4.9 mm (figure and measurements from original description of lectotype).

categories have been defined by Hershkovitz (1990b). The two large species overlap in most dimensions but otherwise are readily separable. The smaller non-intergrading third species differs unmistakably from the others and is described below as new.

Akodon serrensis Thomas (figs 11, 13, table 6)

Akodon serrensis Thomas, 1902: 61.

Holotype. Male, skin and skull, British Museum (Natural History) no. 3.7.1.69 collected 15 August 1901, by A. Robert, original number 803.

Type locality. Roça Nova, Serra do Mar, Paraná, Brazil, elevation between 930—1150 m.

Distribution. Southeastern Brazil, and in the Province of Misiones, Argentina (Justo and Santis, 1977). *A. serrensis* and *A. cursor* were taken in collecting stations Vale Verde, Minas Gerais, and Pedro Roxa, Espírito Santo.

Characters. Pelage deep, lax, the new pelage of dorsum dark reddish or chestnut with the dark brown or blackish bases showing through increasingly with age; underparts with bright orange wash over otherwise exposed dark bases; lateral line not sharply defined; chin, throat bare except for whitish chin patch; tail dark brown above, slightly paler beneath; pedal claws relatively short, fine, recurved, the digital bristles sparse, scarcely extending beyond tip of claw; manual claws slightly shorter, bristles fewer and shorter.

Karyotype. Diploid number 44 (Liascovich & Reig 1989), highest known for the *A. mollis* group.

Comparisons. Distinguished from *Akodon cursor* by overall smaller size, lax, darker pelage particularly on underside, minute manual claws, larger molars, palatine and maxillary bones more inflated particularly where visible through openings of the palatal foramina.

Fig. 9: Skins of *Delomys sublineatus* showing dark middorsal stripe. All specimens from São Paulo, Brazil. From left to right, dorsal and ventral, MZUSP 26961, FM 26595, FM 141628.

Fig. 10: Skins of *Delomys dorsalis* showing dark middorsal stripe. All specimens from Brazil, Minas Gerais, Parque Nacional de Caparaó. From left to right, dorsal and ventral, MN 31934, PH 10089, PH 10373.

Fig. 11: *Akodon serrensis* (MN 32102) skull and molars. GSL, 27.2 mm; molars, 5.4 mm.

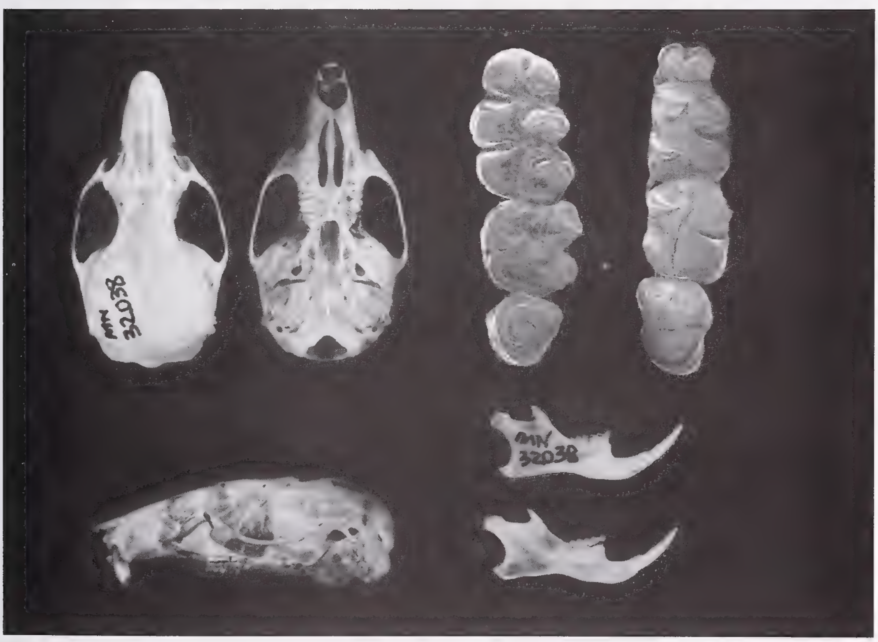


Fig. 12: *Akodon cursor* (MN 32038) skull and molars. GSL, 28.2 mm; molars, 4.5 mm.

Table 5: Selected measurements from Winge (1888: pl. 1, fig. 6) of the figured skull of *Akodon cursor* followed by those of his paratypes.

Greatest skull length	29.5, 28.3
Upper molar row	4.75
Diastema	8.5, 8.3, 7.25, 8.5, 8.0, 8.3, 8.5, 7.67
Length of bulla	4.75
Palate between m^{2-2}	3.0
Incisive foramen	7.33, 7.0, 6.67, 7.3, 7.25, 7.0, 7.25, 6.5
Nasals, length	13.0, 12.67, 11, 13, 12.67
Frontal suture	10.0
Interparietal suture	5.5
Mandible length	16, 14.5, 16.3, 16

Table 6: Sexes compared of Caparaó *Akodon serrensis* and *A. cursor.*

	serrensis ♂	*cursor* ♂	*serrensis* ♀	*cursor* ♀
Head and body	105(92—116)28	124(103—157)25	106(95—115)19	111(101—127)19
Tail	84(78—93)21	95(81—106)23	85(78—94)10	92(81—110)16
Hind foot (c. u.)	25(23—27)25	25(23—28)18	25(24—28)19	25(23—27)20
Weight	30(23—45)28	50(33—65)27	28(18—40)21	35(23—55)19
Condylobasal length	26.0(24.5—26.2)14	28.9(26.3—30.4)22	25.5(24.4—26.6)14	26.7(25.4—27.2)10
Molar row	5.1(5.0—5.5)13	4.5(4.0—4.9)21	4.9(4.4—5.4)14	4.5(4.2—4.8)16

Specimens examined: Total 67. Minas Gerais (Parque Nacional de Caparaó, Pico da Bandeira, 2700 m, MN 7; Tronqueira, 1970—2000 m, MN 4; Terreirao, 2400 m, MN 17; Cachoeira Bonita, 1750 m, MN 21; Segredo, 2100 m, MN 9; Vale Encantado, 1980 m, MN 1; locality? MN 1; Arrozal, 2300 m, MN 1; Vale Verde, 1400 m, MN 1; Casa de Julio, MN 1); Espírito Santo (Pedra Roxa, 1100 m, MN 1).

Akodon cursor Winge (figs 12, 13, tables 5, 6)

Habrothrix cursor Winge, 1887: 25, pl. I, fig. 5 (hindfoot), pl. II, fig. 6 (skull).

Lectotype. Winge's figured skull, basis for the original cranial description, is preserved in the Copenhagen Museum.

Syntypes. The original description is derived from a number of skins, skulls and skeletons preserved in the Universitets Zoologiske Museum, Copenhagen. Ximénez et al. (1972) list the following as syntypes: ZMK 221, 222, 224, 237, 6-VIII-1847 ♀, 5-VIII-1847 ♀, 29-VI-1851, the last three collected by Reinhardt, and an unlisted unnumbered specimen from the Lund collection. Thomas (1902: 60) noted that "one of the co-types . . . [is] in the British Museum."

Type locality. Lagoa Santa, Minas Gerais, central Brazil.

Distribution. Southeastern Brazil from Bahia south, and the central plateau; Uruguay, eastern Paraguay, and Misiones in northeastern Argentina.

Fig. 13: *Akodon cursor* and *A. serrensis*, skulls and molars compared. See figures 11, 12 for data.

Characters. Pelage soft, deep, adpressed; upper parts individually variable from buffy to dark brown; a poorly defined dark longitudinal band sometimes present middorsally, sides paler, the pheomelanin subterminal band of hairs wider, underparts like sides, lateral line of separation absent but slaty basal portion of hairs showing through weakly; muzzle tip more or less dark brown; tail dark brown, thinly covered with short stiff, blackish hairs, the scales fully exposed; cheiridia brown, digits often whitish; ears short, brown; claws short, weak, hardly one phalanx long, middle digits narrowly webbed.

Karyotype. Diploid number, 24 (Liascovich & Reig 1989), lowest known for the *A. mollis* group.

Measurements. Table 6.

Specimens examined: Total 53. Minas Gerais (Parque Nacional de Caparaó, Centro Visitantes, 1300 m, MN 18; Vale Verde, 1400 m, MN 22; locality unrecorded, 3); Espírito Santo (Pedra Roxa, 1100 m, MN 10).

Akodon mystax, new species (figs 14, 15, 16, 24, table 7)

Holotype. Adult female, skin and skull Museu Nacional, Rio de Janeiro, no. 31910, collected 26 October 1992, by Philip Hershkovitz, Scott M. Lindbergh, Alfredo Langguth and Barbara E. Brown; original number, PH 10425.

Etymology. The blackish band from tip of rostrum to corner of each eye in many males and fewer females suggests a mustache.

Type locality. Arrozal, Pico da Bandeira, western slope Mt. Caparaó, Minas Gerais, Brazil, elevation 2300 m.

Distribution. Known from type locality only; captures were at 2300 m, 2400 m, and 2700 m on the western slope of Mt. Caparaó, Minas Gerais, Brazil.

Diagnosis. Thin dark rostral band (mustache) usually present, cheiridea unpigmented, tail bicolor; infraorbital foramen and zygomatic plate hardly visible viewed from above; mesopterygoid fossa wide with posterior palatal margin rounded or square; incisive foramina long, the palatal tips rounded, turned outward.

Description of holotype. Coloration of dorsum from snout to rump brown, the cover hairs with fine blackish tips, followed by a narrow ochraceous orange subterminal band, the bases dark gray; sides paler, the pheomelanin subterminal band wider, the color dominant on ventral surface but with plumbeous basal portions of hairs exposed; tail brown above, sharply paler beneath; dark rostral band present from snout to side of face; ears brown, cheiridea unpigmented; length of digits normal, claws short, unspecialized.

Variation. Pelage deep, fine, almost lax, about 10 mm long on back; dorsum from rostrum to tail base buffy to grayish brown, the subterminal band of hairs buffy to ochraceous becoming paler toward sides of body; underparts paler, with an ill-defined lateral ochraceous buff line of demarcation, the slaty hair bases showing through; tip of rostrum usually with narrow dark brown patch often extending across each side as a mustache to or near corner of eye; ears brown, in some rimmed pale buff; cheiridia pale above and below; first manual digit with nail not extending to base of second digit; digit II with claw extending to base of 2nd phalanx of III; digit IV slightly shorter than III, V with claw extending to base of 3rd phalanx of IV; pedal digit I with claw extending to middle of 1st phalanx of II; length of digits II, III, IV, subequal, the middle slightly longer; interdigital membranes absent; claws short, recurved, the pedal longer than the manual; tail distinctly bicolor, the hairs nearly concealing the scales. The general aspect is of a grayish buffy animal.

Sexual dimorphism. Males are larger than females in external dimension and tend to have slightly larger skulls (table 6). Most size differences in this case, however, are inconsequential; blackish rostral patch or mustache in nearly all males, is less prevalent and extensive in females.

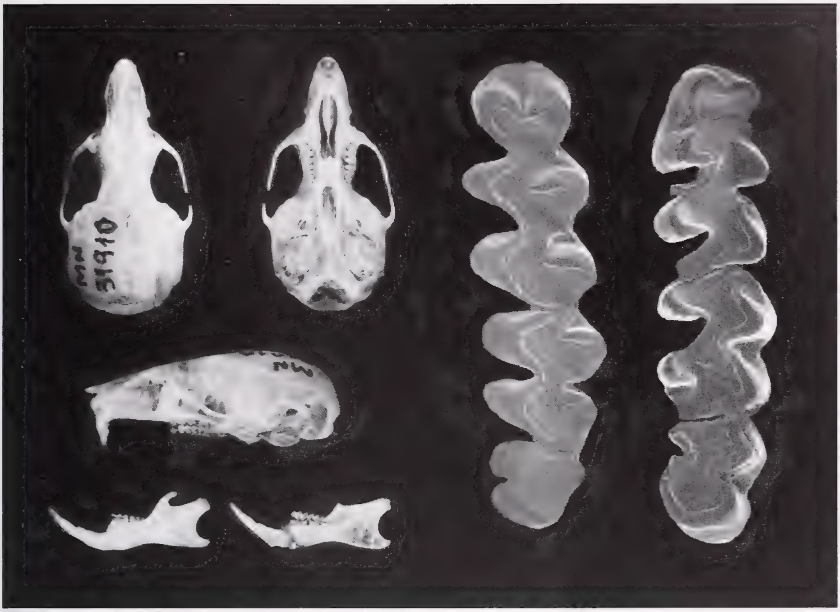


Fig. 14: Mustached Akodon, *Akodon mystax* (holotype MN 31910 ♀); skull and molars; GSL, 24.3 mm; molars, 3.9 mm; Arrozal, Parque Nacional de Caparaó, Minas Gerais.

Comparisons. *Akodon mystax* is a member of the *Akodon boliviensis* group or size class defined by Hershkovitz (1990b: 3). Males of all species of the *boliviensis* group are larger than females in external dimensions. Nearest relatives appear to be *Akodon sanctipaulensis* (São Paulo), *A. lindberghi* (Brasília, D. F.), and *A. azarae* (Paraguay, Argentina and Uruguay). Similarities between Andean and Atlantic region akodonts of the *boliviensis* group may be more than superficial, but the diagnostic characters of *mystax* are significant; the karyotype is as yet unknown. The posterolophule (pseudomesoloph) often fused with the posterostyle usually absent in *A. mystax* is not consistently present in other species.

Morphometric differences between the species are slight; comparative measurements of most other members of the *boliviensis* size class are given by Hershkovitz (1990b: 4–5).

Measurements. Table 7.

Remarks. Several of the specimens were taken in a small stone house in Terreirao occupied only by the mice until Scott Lindbergh and Alfredo Langguth moved in. A mustache like that of *Akodon mystax* is common among sigmodontines, marsupials and other mammals usually as an individual variable.

Specimens examined: Total 21. Minas Gerais (Parque Nacional de Caparaó, Terreirao, 2400 m, MN 13; Arrozal, 2300 m, MN 5; Pico da Bandeira, 2700 m, MN 3).

Thaptomys Thomas

Thaptomys Thomas, 1916: 339. Type species *Hesperomys subterraneus* Hensel, 1872 (= *Thaptomys nigrita* Lichtenstein, 1829).

The genus *Thaptomys* Thomas, 1916, one of the most distinctive of the akodontine assemblage has experienced an equivocal systematic history. Ellerman (1941: 406, 409) characterized *Thaptomys* as "quite a well differentiated group," but treated it

Table 7: Measurements of *Akodon mystax* compared with *A. azarae* and *A. boliviensis*.

	mystax[1] Holotype ♀	*mystax*[2] ♂	*mystax*[2] ♀	*azarae*[3] ♂	*azarae*[3] ♀	*boliviensis*[4] ♂	*boliviensis*[4] ♀
Head and body	92	95(85−101)11	90.4(87−99)8	102(94−113)9	97(92−101)7	98(92−100)5	96(83−107)6
Tail length	64	67(63−73)11	63.7(59−68)8	65(57−72)9	62(57−67)7	72(62−82)5	70(64−77)6
Hind foot	17	19(17−22)11	17.6(16−19)8	20.5(20−21.5)9	20(19−20.5)7	21(20−23)6	21(19−22)6
Ear	12	13(12−14)11	13(12−14)8	—	—	—	—
Weight	—	19(16−25)12	18(13−26)7	—	—	—	—
Greatest skull length	24.3	24.6(24.0−25.4)11	24.3(23.6−24.6)8	24.7(23.8−26.1)9	23.8(22.8−24.7)8	25.1(24.5−26.0)5	24.5(24.1−25.0)6
Condylobasal length	22.9	23.2(22.5−24.0)10	22.6(22.0−23.2)7	22.9(21.9−24.6)9	21.9(20.8−23.2)8	23.2(22.4−24.0)5	22.7(21.9−23.6)6
Zygomatic breadth	12.4	12.1(11.5−12.7)9	11.9(11.6−12.4)8	12.1(11.3−12.6)9	12.0(11.4−12.6)8	12.4(11.8−12.9)6	12.2(11.9−12.5)6
Interorbital width	4.5	4.5(4.4−4.6)11	4.4(4.1−4.6)8	4.0(3.8−4.3)9	4.1(3.9−4.5)8	4.5(4.2−4.7)6	4.4(4.3−4.6)6
Braincase width	10.9	10.9(10.5−11.3)11	10.9(10.5−11.2)8	11.1(10.9−11.6)9	11.2(10.7−11.6)8	11.4(11.2−11.7)6	11.4(11.1−11.5)6
Nasal length	9.0	8.9(8.3−10.7)12	8.6(8.0−9.0)8	9.0(7.8−9.5)9	8.9(8.2−9.5)8	9.4(8.0−10.6)5	9.0(8.3−9.9)6
Incisive foramen	6.9	6.8(5.7−7.3)12	6.7(6.4−6.7)8	6.1(5.8−6.5)9	5.9(5.6−6.4)8	6.1(5.8−6.5)5	5.8(5.5−6.1)6
Palate, length	2.7	2.8(2.6−3.0)11	2.8(2.7−3.0)8	3.3(3.0−3.6)9	3.1(2.8−3.3)8	3.3(2.9−3.8)6	3.2(3.1−3.5)6
Zygomatic plate	1.8	1.8(1.6−2.0)12	1.7(1.3−2.1)8	2.3(2.1−2.5)9	2.1(1.9−2.3)8	2.0(1.7−2.3)6	2.0(1.8−2.4)6
Molar row	3.9	3.9(3.5−4.2)12	3.9(3.6−4.3)8	4.2(4.1−4.3)9	4.0(3.8−4.2)8	3.8(3.5−4.0)6	3.9(3.7−4.5)6
Diasteme	6.4	6.5(6.2−6.8)12	6.3(6.0−6.4)7	—	—	—	—
Rostrum, width	4.4	4.8(4.4−5.0)7	4.3(4.2−4.7)8	4.2(3.9−4.5)9	4.2(4.0−4.4)7	4.5(4.4−4.7)5	4.3(4.2−4.5)6
Mesopterygoid fossa	1.54	1.53(1.40−1.64)5	1.49(1.39−1.54)7	1.3(1.0−1.6)9	1.3(1.0−1.5)6	1.3(1.1−1.4)6	1.3(1.0−1.8)5

[1] *Akodon mystax*, BRAZIL: *Minas Gerais* (Caparaó National Park, Arrozal, 2300 m), MN 31910
[2] *Akodon mystax*, BRAZIL: *Minas Gerais* (Caparaó National Park, 2300−2700 m) MN
[3] *Akodon azarae*, ARGENTINA: *Buenos Aires* (Torrecita) FM
[4] *Akodon boliviensis*, PERU: *Puno* (Limbani) FM.

Fig. 15: Skulls of three species of *Akodon*: A, *A. mystax* (holotype MN 31910 ♀); GSL, 24.3 mm; Arrozal; B, *A. azarae* (FM 27616 ♂), GSL, 23.9 mm; Uruguay, La Lata; C, *A. boliviensis* (FM 51293 ♀); GSL, 24.0 mm; Perú, Puno, Yunguyo.

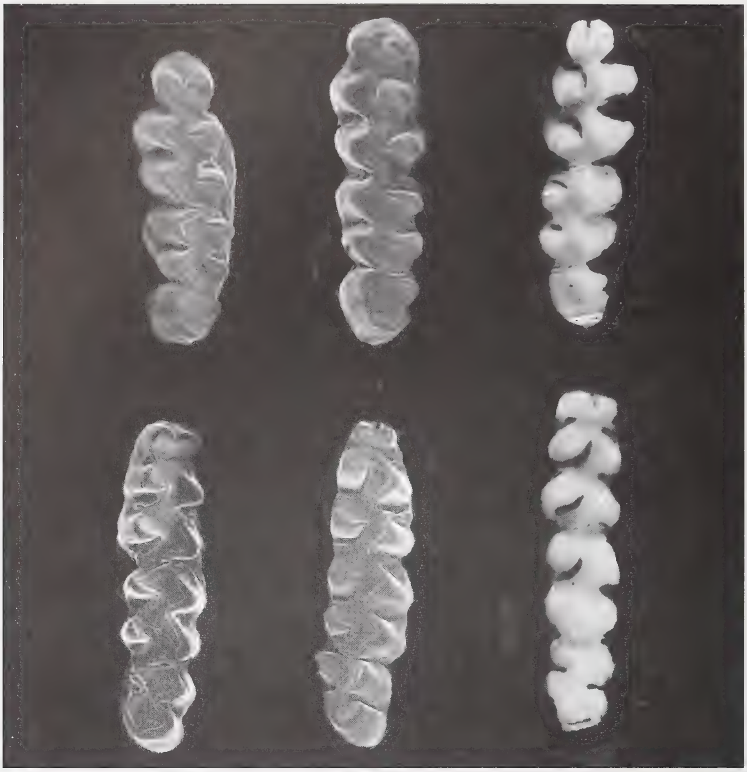


Fig. 16: Molars of three species of *Akodon*, same shown in figure 15. Upper row, upper molars, A, *A. mystax*, 3.9 mm; B, *A. azarae*, 4.0 mm; C, *A. boliviensis*, 4.0 mm; Lower row, lower molars, *A. mystax*, 4.0 mm; *A. azarae*, 4.1 mm; *A. boliviensis*, 4.0 mm.

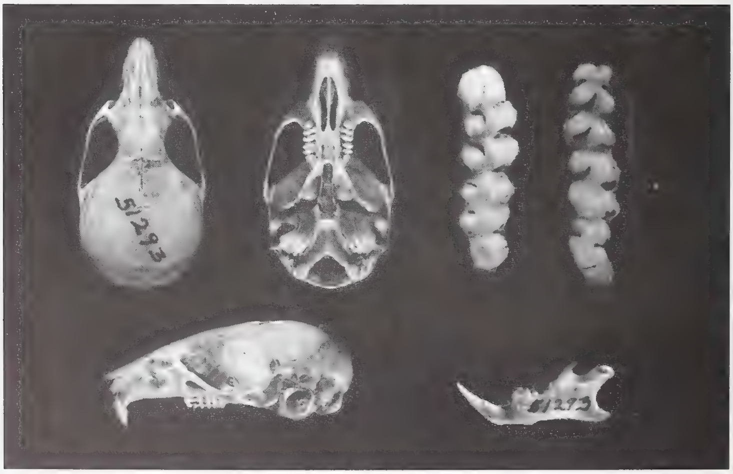


Fig. 17: Bolivian *Akodon boliviensis* (FM 51293); skull and molars; GSL, 24.0 mm; molars, 4.0 mm; Perú, Puno, Yunguyo.

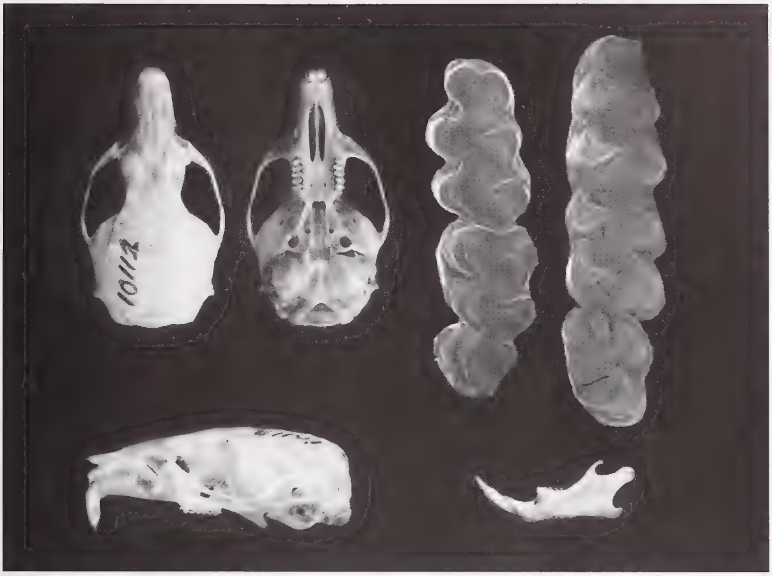


Fig. 18: *Thaptomys nigrita* (PH 10112 ♂); skull and molars; GSL, 24.5 mm; molars, 3.6 mm; Pico da Bandeira, Parque Nacional de Caparaó, Minas Gerais.

as a subgenus of *Akodon*. Cabrera (1961: 453) followed without comment. Reig (1987: 358), with judgement derived from unrevealed sources declared that "separation of *Thaptomys* from *Akodon* s. s. is unwarranted." Nothing, he averred, distinguishes the taxon "beyond the limits of variation with *Akodon* s. s."

The peculiarity of a single pair of prostate glands in *Thaptomys nigrita* was not appreciated by Reig, and the highly advanced fossorial adaptations of the mouse (table 12) were dismissed as "alleged," and "too incipient to deserve any special taxonomic treatment." It has since been shown (Hershkovitz 1990b: 6), "that the short tail, long manual claws, heavy skull, ridged parietals, short, thick rostrum with long nasal bones, wide interorbital region, squared braincase, relatively small molars, long powerful proodont incisors projecting well beyond the nasals, and the diploid chromosome number 52, are singly or in any combination definitely non-*Akodon*." Musser & Carleton (1993: 691) however, retained *Thaptomys* in the synonymy of *Akodon*.

Thaptomys nigrita Lichtenstein (fig. 18)

Mus nigrita Lichtenstein, 1829 p. 35, fig. 1 (animal). Thomas 1902: 62 — synonyms: *subterraneus* Hensel 1872, *henseli* Leche, 1886, *fuliginosus* Wagner, 1845, *orycter* Lund, 1841.

Holotype. Male, skin only, Zoological Museum, Berlin.

Type locality. Vicinity of Rio de Janeiro, Brazil.

Distribution. Southeastern Brazil from the State of Bahia south through Minas Gerais, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul into eastern Paraguay, and in Argentina, the province of Misiones.

Table 8: *Thaptomys nigrita*: Measurements from three localities.

Localities	Pico de la Bandeira Caparaó, MG[1]	Iporanga, SP[2]	Espírito Santo[2]
Head and body	101(95−107)11	103(97−105)9	99(82−116)7
Tail	46(40−50)11	47(42−50)9	42(30−50)7[4]
Hind foot	19(17−21)11	18.5(17−23)9	19(16−20)7
Ear	10(10−12)11	11.5(10−12)8	11(10−12)7
Weight	22(13−29)11	25(17−30)4	26(20−31)4
Greatest skull length	24.1(23.3−24.7)5	25(22.7−25.4)6	24.5(23.9−25.3)7
Condylobasal length	23.6(22.5−24.3)6	24.2(21.4−25.0)6	24.0(22.8−25.0)7
Zygomatic breadth	13.2(12.5−13.6)6	13.4(12.1−14.2)6	13.4(12.8−13.9)6
Interorbital breadth	5.0(4.4−5.3)6	4.9(4.7−5.0)8	5.1(4.8−5.3)7
Braincase width	11.1(10.7−11.8)6	11.7(11.5−12.0)8	11.7(11.3−12.1)7
Nasal length	8.5(8.2−8.7)5	8.8(7.5−9.2)8	9.2(7.5−10.2)6
Incisive foramina	5.8(5.2−6.7)6	5.5(4.8−6.0)9	5.3(4.9−5.8)7
Palatal length	3.9(3.6−4.7)6	3.7(3.3−4.4)8	3.9(3.7−4.1)7
Zygomatic plate	2.4(2.1−2.5)6	2.3−(2.0−2.6)8	2.4(2.1−2.7)7
Molar row	3.7(3.6−3.8)6	3.7(3.5−4.1)9	3.7(3.6−3.8)7

[1] MN and FM; [2] MZUSP and FM; [3]Includes MN: Caira Laguna, Santa Teresa, 3; Castelo, 3; Cachoeira de Hapanurim, 1; [4] Includes some "bobbed-tailed" specimens.

External. One of the smallest mammals of the Caparaó region; pelage velvety, coloration brown, ranging from a milk chocolate color to a dark brown on dorsal surface; sides and underparts with orange, the dark slaty hair bases showing through; forwardly directed pelage of neck and throat with less orange; tail half or less length of head and body combined, the short stiff hairs brown above, whitish below, not concealing scales; ears short, eyes small; manual claws long, fine, the middle pair longest, pedal claws shorter.

Eight teats are said to be the norm for *Thaptomys* (Hensel 1872; Gyldenstolpe 1932; Davis 1947: 6). I count 6 in 2 Caparaó females, 6 in 3 of the FM collection but nipples, especially the pectorals, are difficult to detect in dry skins during the wrong time of the breeding season.

Cranial. Rostrum short, nasals not extending to front of incisors; supraoccipital bone inclined forward; zygomatic arches delicate, the perpendicular plate broad, visible from above; interorbital borders smooth, slightly concave and divergent; incisive foramina longer than molar row and extending to plane of metacones of first molars; palate long, extending behind to level of third molars; posterolateral palatal pits present but highly variable in size; spheno-palatine vacuities absent or not indicated.

Dental. Upper incisors proodont extending well anteriad to tips of nasal bones; molars moderately high crowned; unworn crowns terraced, anteromedian flexus well defined, the procingulum biconulate; talon and trigon of M^{1-2} subequal in width and length, without postcingulum; paralophule (pseudo-mesoloph) usually fused with metalophule; third molar about as large as talon of second, cusps of opposite sides oblique; first lower molar with anteromedian flexid, opposing cusps oblique; protolophid and posterolophid present; posteroflexid of m_3 absent.

Worn upper and lower crowns acquire the typical akodont dished-out eight-shape appearance.

Measurements. Table 8.

Remarks. The later named forms of *Thaptomys* (*fuliginosus* Wagner, 1845; *subterraneus* Hensel, 1872; *henseli* Leche, 1886) were distinguished by coloration only, and the fossil *orycter* Lund (1841) by cranial characters. The traits are highly variable, none consistently distinctive of any one described form.

The abbreviated rostrum and thick, projecting proodont incisors appear to be adaptations for tunnel burrowing.

Comparisons. Small size, one of smallest of Caparaó mammals, markedly proodont incisors, short thick rostrum and long manual claws among other characters distinguish *Thaptomys* from all other mammals of the region.

Habits and habitat. In his description of *Hesperomys subterraneus* (= *Thaptomys nigrita*) from Rio Grande do Sul, Hensel (1872: 45) noted that the species lived in virgin forest and made burrows like that of the European *Arvicola arvalis* (= *A. terrestris*). Whether or not it nested in family groups like the microtine was not mentioned.

The home range of southeastern Brazilian marsupials and mice was estimated by Davis (1945: 124) by recapturing marked animals in second-growth forest near Teresópolis, Rio de Janeiro. The three common species, *Delomys dorsalis, Akodon arviculoides* and *Thaptomys nigrita* were recaptured a total of 152 times. Only 15 individuals were recaptured more than 100 m along the trail between farthest capture sites. The data led Davis to assert that the radius of the home range of each of these species was less than 100 meters.

In a second, more detailed account, Davis (1947: 6) described *Thaptomys nigrita* as an aggressive little mouse, "the second [after *Akodon arviculoides*] most common mammal in the forests [around Teresópolis, Rio de Janeiro]. It is found under logs and tree roots and even makes tunnels in the leaf litter and soft earth. When released alive from the hand it immediately washes its face and cleans its fur and then disappears in a hole. This mouse is very fierce and quickly inflicts a sharp bite when handled. However, several were trained to come out of their holes to look for kernels of grain; they did not eat outside the hole, but grabbed the seed and ran back into the hole. This species is definitely diurnal, for many individuals were captured in the daytime and were regularly seen in the daytime. One mouse was caught 3 times in one afternoon. The sex ratio was about even (80 males and 75 females). There are 4 pairs of mammae. Only 4 pregnant females were examined; 1 had 3 embryos, 2 had 4, and 1 had 5. This little mouse has no conception of climbing, but when placed on a limb runs in any direction and falls to the ground. Recaptures of marked individuals indicate that these mice stay in one place for a long time."

A test for burrowing was made with an adult I captured live at the mouth of a burrow 30 November 1989 in second-growth forest fringing a banana patch in the Iporanga state park. The mouse was introduced into a 12x12x12 wire mesh cage filled nearly to the top with clay. The animal burrowed the instant freed and in seconds dug itself out of sight. The finished tunnel system had three outlets. The first was on top where excavation started. The other two were each at opposing corners of the cage. The mouse was fed corn kernels, peanuts, seeds, and watermelon deposited inside the cage. All was taken into the burrow for eating. The mouse came frequently out of hiding during the day. When frightened it dived into the nearest hole each about 2 inches in diameter but the mouse could negotiate a tunnel a centimeter wide.

Specimens examined: Total 24. Minas Gerais (Parque Nacional de Caparaó, Segredo, 2100 m, MN 1; Vale Verde, 1400 m, MN 4; Cachoeira Bonita, 1750 m, MN 3; Terreirao, 2400 m, MN 3; Pico da Bandeira, 2700 m, MN 1). São Paulo (Iporanga, MZUSP 10).

Brucepattersonius, new genus (figs 19—26)

Type species. *Brucepattersonius soricinus* (new species).

Etymology. The genus is named in honor of Bruce D. Patterson as an expression of my admiration for his mastery of all aspects of mammalogy whether in the field, laboratory or classroom, and in appreciation for his valued friendship.

Included species. *Oxymycterus iheringi* Thomas and the following described as new: *B. soricinus* (type species), *B. igniventris, B. griserufescens, B. albinasus,* and an unnamed species (not seen) from Misiones, Argentina.

Diagnosis. Head and body combined less than 140 mm; tail from shorter to a fourth longer than head and body combined; eyes minute; rostrum long, tapered; longest manual claw 3 mm or less, pedal 1 or 2 mm longer than manual; digital

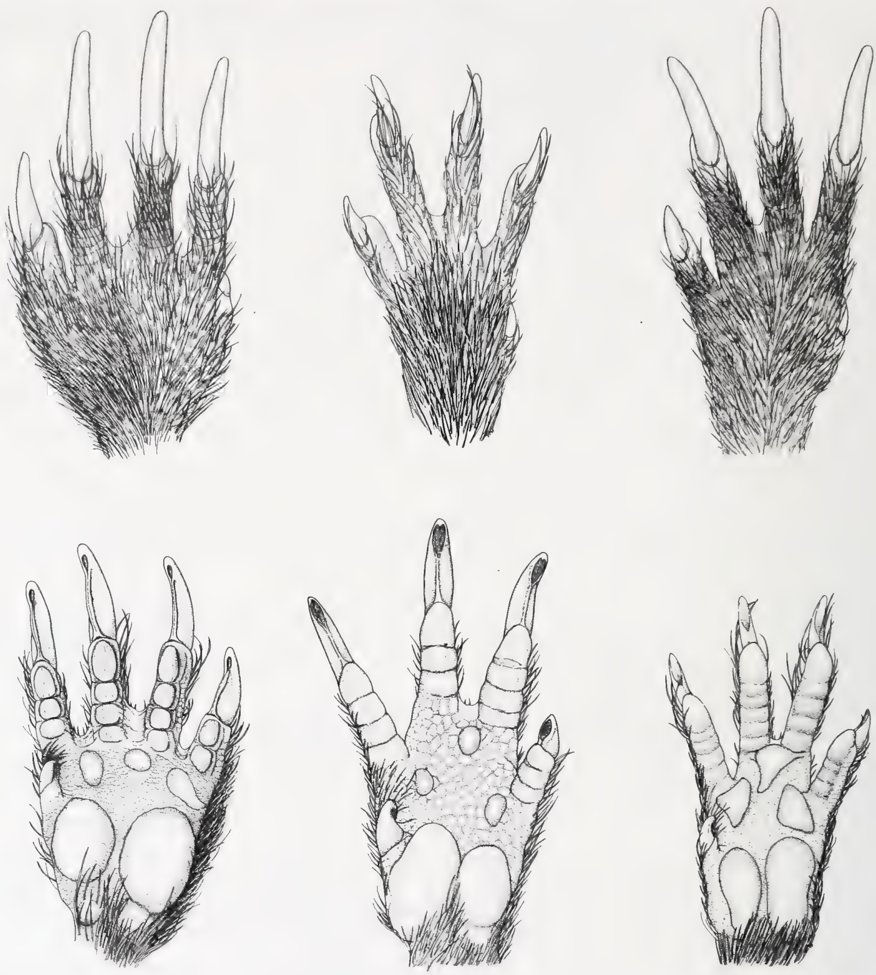
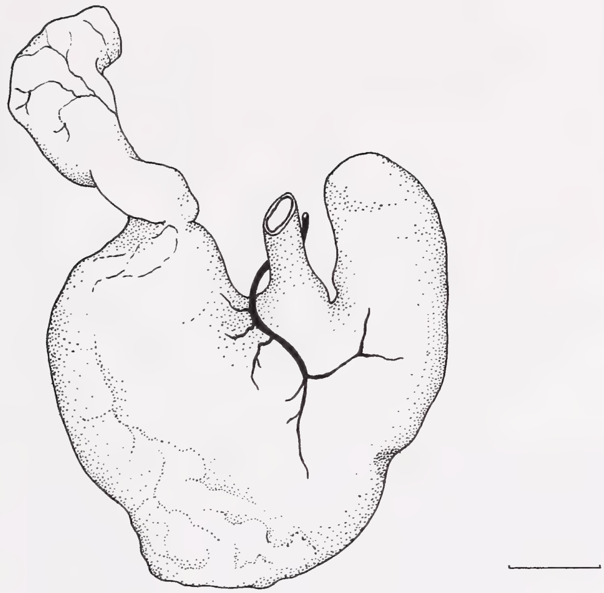


Fig. 19: Left hands of sigmodontine rodents. Upper row dorsal surface, from left, *Chelemys megalonyx*, fossorial; *Oxymycterus amazonicus*, nonfossorial surface digger; *Brucepattersonius griserufescens*, terrestrial semiscansorial. Lower row, palmar surface of same hands in same order as shown above.

vibrissae on three middle manual digits extremely sparse or absent on digits I and V; sphenopalatine vacuities absent; nasals produced anteriorly to or beyond plane of incisors, tips rounded or bluntly pointed; rostral width less than that of interorbital region; molars tetralophodont, quadritubercular, hypsodont; first molar with anterior median fold; mesoloph(id) present to absent; upper incisors short, narrow, orthodont; cuspids more or less subprismatic.

Distribution. Southeastern Brazil from the state of Rio Grande do Sul north into eastern Minas Gerais and probably some part of Espírito Santo; in Argentina known from the province of Misiones.



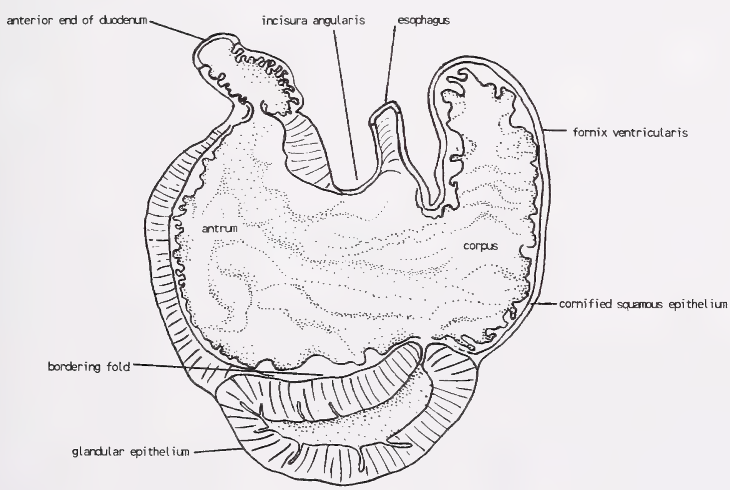


Fig. 20: Unilocular-hemiglandular stomach of *Brucepattersonius griserufescens*; A, ventral aspect; B, the same bisected, the ventral half removed.

Description. Length of head and body combined (HB) between 75—140 mm; tail between 75—120 mm; ear about 14 %—20 % HB; hind foot with claw between 23 %—28 % HB; adult weight between 18—50 g; general coloration of dorsum dark brown, sides of body usually paler with greater admixture of pheomelanin; underparts and inner sides of limbs dominantly grayish or dominantly ochraceous orange (pheomelanin); rostrum long, tapered, eyeballs small, diameter 1 to 2 mm; hind foot long, narrow, base of middle digits webbed; volar pads 6; pedal claws 3—4 mm; manual claws weak, longest 2—3 mm; manual digit I vestigial, inungulate; gall bladder present; stomach unilocular-hemiglandular with glandular epithelium contained in a pouch-like diverticulum (fig. 20).

Nasal bones long, tapered, produced to front of incisors or 1 to 2 mm beyond, tips rounded or bluntly pointed, not squared, flared or trumpet-shaped; premaxillary bones not reaching nasal tips; sphenopalatine vacuities absent; zygomatic arches weak, hardly spread beyond greatest width of braincase; zygomatic plate narrow, markedly reclined, hardly visible viewed from above; interorbital region smooth, wide; braincase smooth, subglobular, interparietal length 1 or 2 mm; incisive foramina long, narrow, terminating slightly behind anterior plane of M^1; palate produced to or slightly behind posterior plane of M^3.

Molars tetralophodont, hypsodont; molar rows parallel-sided or slightly convergent posteriorly; first molars with median fold, enamel of anterior margin of m_1 more or less crenulate; mesoloph(id) present to absent; upper cusps ovate to subtriangular, cuspids subprismatic, the opposing pairs in echelon.

The following description of the molars is based primarily on comparison of the type species of *Brucepattersonius* with that of the type species of *Oxymycterus* (*O. nasutus*). Less worn molars of other than the type species would reveal characters probably undetected in the worn teeth described here. For molar terminology see figs 31, 32.

Upper Molars

M^1. Procingulum with well defined anterior median fold, the anterolabial lophule (*b*) and anterolingual lophule (*c*) well defined; anteromedian style (*a*) absent; other elements absent in *B. soricinus* but present in *Oxymycterus nasutus* are anterolophule (*d*), anteroloph (*h*), paralophule (*m*), and enteroloph (*w*); mesoloph (*n*) present to absent in *Brucepattersonius.*

M^2. Procingulum vestigial, the major and minor enamel folds or flexi shallow but the four principal cusps well defined; mesoloph (*n*) absent.

M^3. Very simple with paraflexus (*3*) and entoflexus (*9*) reduced to enamel islands.

Lower Molars

m_1. Procingulum with shallow anterior median fold; the anterior enamel margin crenulate; labiolophulid (*d*) present, usually fused with protostylid (*g*); ectolophid present; mesolophid (*v*) present; lophids or lophulids absent in *B. soricinus* but present in *O. nasutus* are anterolophid (*h*), anterolophulid (*f*), mesolophulid (*s*), metalophulid (*u*), entolophulid (*x*); median fossette (*b*') and posterior fossette (*c*').

m_2. Short mesolophid (*v*) fused with metalophulid (*u*); ectolophid (*n*) and entolophid (*x*) absent; posterior fossette (c') present.

m_3. In this and m_2, the superflexid (*7*) defines what remains of the procingulum; lophids and lophulids absent, enamel folds indicated by indentations of the marginal enamel; m_3 about 2/3 bulk of m_2.

Comparisons. *Microxus* differs by much smaller size; claws longer, as in *Oxymycterus*; palate oryzomyine in length with posterolateral pits; mesoloph complicated or pseudopentalophodont with fused paralophule (*m*), metalophule (*p*) and mesostyle (*o*); mesolophid not certainly distinguishable.

Oxymycterus differs by bulbous rostrum; much longer, heavier claws, the manual as long or longer than the pedal; nasals more or less parallel-sided, tips square, often trumpet shaped; cusps (ids) more or less ovate, the inner and outer pairs more nearly opposite.

Abrothrix, once linked with *Oxymycterus*, is unrelated. Among the more obvious differences between it and *Brucepattersonius* are large or normal-sized eyeballs, simplified baculum, mesopterygoid vacuities present, zygomatic arches expanded, zygomatic plate stout, upright, anterior median folds absent in upper and lower first molars.

Relationship. *Brucepattersonius* is the akodontine apparently most nearly related to *Oxymycterus*, with which it had been confused. All distinctive characters of *Oxymycterus*, most notably larger overall size, long front claws, shorter hind claws, small ears and eyes, short tail, long snout, stomach morphology, diet, dental and cranial characters generally and geographic and ecological orientation, can be derived from an ancestral form near *Brucepattersonius*.

Distribution, associations. *Brucepattersonius* is the soricine sigmodontine supreme with its small size, long, slim body, short limbs, elongate tapered snout, small eyes, short ears and mainly if not entirely insectivorous diet. It is remarkable that the existence of this distinctive faunule, relatively uncommon but widespread over the well studied southern half of the Atlantic rain forest, should not have been appreciated until now. *Brucepattersonius* with its six currently recognized (including one unnamed) species proves to be one of the more speciose of the akodontine genera. The sylvan associates within its geographic range are *Blarinomys breviceps, Akodon serrensis, A. sanctipaulensis,* and *A. mystax* described here. *A. cursor* is essentially pastoral where trapped in Caparaó but the habitat was formerly sylvan. The monotypic *Thaptomys nigrita* is the burrowing sylvan form. The pastoral *Oxymycterus* is represented by the large *O. hispidus* or *O. rufus* and a smaller species described here as new. The sylvan oryzomyine-thomasomyine sigmodontines commonly occuring with *Brucepattersonius* are *Delomys* (*D. dorsalis, D. sublineatus*), *Oryzomys* (*O. ratticeps, O. capito, O. intermedius*), *Oligoryzomys* (*O. microtis, O. nigripes, O. fornesi,* and possibly one or two undescribed forms). A species each of *Rhipidomys, Rhagomys*(?), *Oecomys*, and *Nectomys* are the known remaining sylvan associates.

Key to species of *Brucepattersonius*

1a. Rostrum white; tail length more than combined head and body length ...... *albinasus*
1b. Rostrum dusky; tail longer or shorter than combined head and body length 2

2a. Tail less than 90 % as long as combined head and body length; underparts grayish with ochraceous wash .... *soricinus*
2b. Tail 90 % as long or longer than combined head and body length 3

3a. Underparts dominantly grayish .... *griserufescens*
3b. Underparts dominantly reddish or orange .... *igniventris*

Note: The unidentified specimens from Tobunas, Puerto Gisela and Dos de Mayo with measurements given in table 8 represent an unknown species identified as *Oxymycterus iheringi* Thomas by Massoia (1963a), and Massoia and Fornes (1969). They have not been seen by me. They occur well outside the geographic range of those described here but may be congeneric.

Brucepattersonius soricinus, type and new species (fig. 21) — Soricine Brucie

Holotype. Adult male, skin and skull FM no. 94480, collected 26 July 1961, by A. M. Olalla, original number 1290.

Type locality. Ribeirão Fundo, São Paulo, Brazil.

Distribution. Known from type locality, and nearby localities Primeiro Morro and Morretinho, southwestern São Paulo, Brazil.

Diagnosis. Size smallest of genus except *B. albinasus* (new), described below, tail shortest relative to head and body length, general coloration brownish, underparts gray with ochraceous wash, skull and rostrum broadest.

Description of holotype. Pelage moderately adpressed, of dorsum about 8 mm long not concealing ears; crown to rump brown, cover hairs with tips minutely tipped blackish, followed by ochraceous orange band, remainder plumbeous; guard hairs entirely blackish; sides of trunk paler than back, the ochraceous bands wider, basal portions of hairs gray, the whole merging into grayish chest and belly with hairs broadly banded pale ochraceous, bases dark gray; throat, chin dominantly gray, the hairs directed forward; coloration of fore and hind limbs like that of trunk; longest claw of forefoot measured in straight line about 2 mm, of hind foot 4 mm; digital vibrissae sparse; facial vibrissae short, hardly reaching ear base when laid back.

Cranial. As described for the genus.

Dental. Anterior median fold or flexus present in first upper molar; mesoloph, protoloph, anteroloph and enteroloph absent; opposing cusps slightly oblique, form subprismatic.

Lower first molar with anterior flexid; mesolophid absent in first molar, sometimes present in second; labiolophulid present; anterolophid absent; ectolophid present; cusps more or less subprismatic.

Measurements. Table 9.

Type series. Essentially like holotype but average darker on dorsal suface, more reddish on chest, belly.

Comparisons. Smaller than other congenerics except *albinasus*, underparts less gray than in *B. griserufescens* (new) described beyond; more nearly like *igniventris* (new), see below, in size, proportions, coloration except throat, chin more gray, chest less orange; skull and rostrum broader.

Specimens examined: Total 6. São Paulo (Ribeirão Fundo, FM 1; Morretinho, FM 1; Primeiro Morro, FM 4).

Brucepattersonius igniventris, new species (fig. 22) — Red-Bellied Brucie

Holotype. Adult male, skin and skull. MZUSP no. 27000, collected 1 December 1989, by Philip Hershkovitz, Scott Lindbergh and Barbara E. Brown, original no. 9871.

Type locality. Iporanga (Petar) State Park, southwestern São Paulo, Brazil.

Distribution. Known only from type locality in the forested (now second growth) highlands of southwestern São Paulo.

Diagnosis. Reddish brown dorsally, reddish orange ventrally; tail shorter than head and body combined; longest manual/pedal claws on digits II, III; muzzle attenuated, nasal tips projected well beyond incisors.

Description of holotype. Most reddish brown species on upper parts, most intensely reddish orange on underparts, limbs, sides of head; a broad orange lateral line between reddish underparts and reddish brown upper parts.

Description of type series. Pelage of dorsum fine, soft, adpressed, the hairs 7—8 mm long; coloration of snout to rump reddish brown, sides slightly more reddish merging into dominantly reddish orange of cheeks, chin, throat, arms, belly, legs; the chest more uniformly reddish than other parts, the slaty bases of hairs showing through on belly; tail uniformly brownish, thinly clothed, the scales clearly visible, short thin pencil whitish to brownish; ears brown nearly hidden in fur; upper surface of fore and hind feet pale to dark brown; claws little recurved, short, weak; digital vibrissae of three middle toes whitish, vibrissae sparse or absent on outer toes; manual claws small, thin, seemingly ineffectual; facial vibrissae thin, the longest barely reaching ear base when laid back.

Cranial. Nasals slender, tips rounded; palate long, extending to posterior plane of m^3.

Dental. Worn in all 3 available specimens; anterior flexus (id) of $m\frac{1}{1}$ evident.

Measurements. Table 9.

Comparisons. Coloration more reddish throughout, particularly of underparts, than in all other known forms; skull smaller than that of *griserufescens*, and the Argentine (Misiones) species; nasals longer more slender than in *B. soricinus*.

Specimens examined: Total 3. São Paulo (Petar, Iporanga, MZUSP 3).

Brucepattersonius griserufescens, new species (fig. 23) — Gray-Bellied Brucie

Holotype. Adult female, skin and skull, Museo Nacional, Rio de Janeiro, no. 32016, collected 7 October 1992, by Philip Hershkovitz, Scott M. Lindbergh, Alfredo Langguth and Barbara E. Brown, original number PH 10234.

Type locality. Terreirão, Parque Nacional de Caparaó, Minas Gerais, Brazil, elevation 2400 meters.

Distribution. Known only from the western slope of Mt. Caparaó, Minas Gerais; collected from 2100—2400 meters above sea level in remnants of Atlantic forest.

Diagnosis. Largest species of the genus; tail nearly as long to longer than head and body combined, underparts dominantly grayish.

Description of type series. Dorsum uniformly brownish from rostrum to tail base, pelage silky, hairs about 10 mm long, narrow subterminal band ochraceous orange, gray hair bases entirely concealed beneath long lax fur; sides of trunk and limbs like back; underparts grayish, variably washed pale ochraceous and more or less defined from sides; tail uniformly brown, the dorsal hairs about 1 scale long, ventral hairs, tip and pencil whitish, about 3 scales long, the scales showing through; ears brown, partly hidden in fur; hands and feet pale brown above, the palms pigmented or unpigmented, the soles brown; manual claws 2 mm long, pedal claws 4 mm; tail of holotype bobbed.

Remarks. Average tail length about equal to average combined head and body length, but 6 of 9 intact tails are longer, 2 slightly shorter, 1 same, as combined head and body length.

Measurements. Table 9.

Cranial. Muzzle long, slender, tapered, nasal tips rounded; zygomatic plate little exposed seen from above; interorbital edges rounded, braincase smooth; spread of zygomatic arches

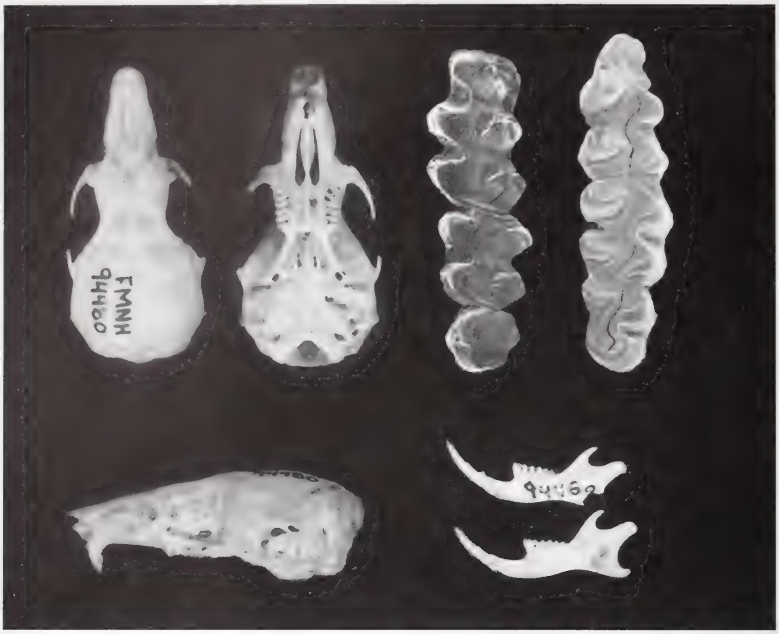


Fig. 21: Soricine Brucie, *Brucepattersonius soricinus* (holotype FM 94480 ♂); skull and molars; GSL, 27.8 mm; upper molars, 4.2 mm; Ribeirão Fundo, São Paulo.

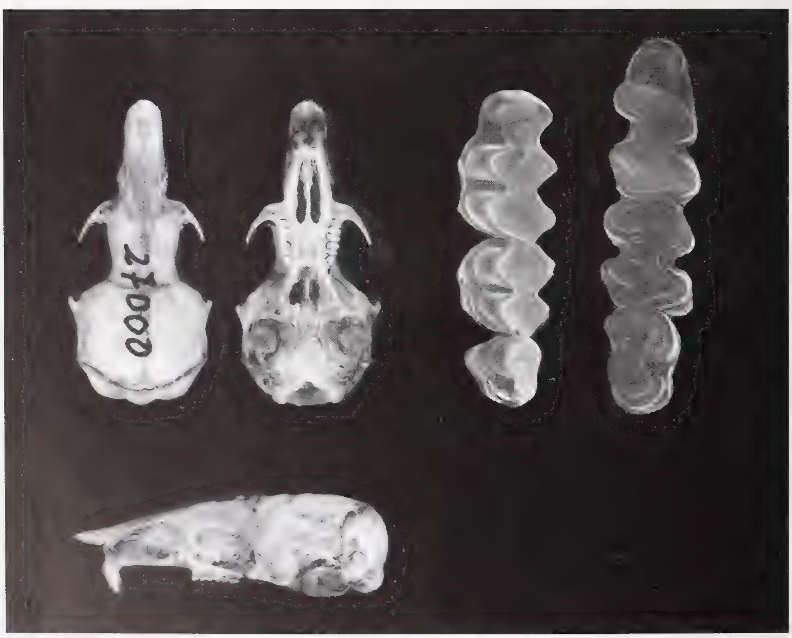


Fig. 22: Red-bellied Brucie, *Brucepattersonius igniventris* (holotype MZUSP 27000 ♂); skull and molars; GSL, 25.5 mm, molars, 4.5 mm; Petar, Iporanga, São Paulo.

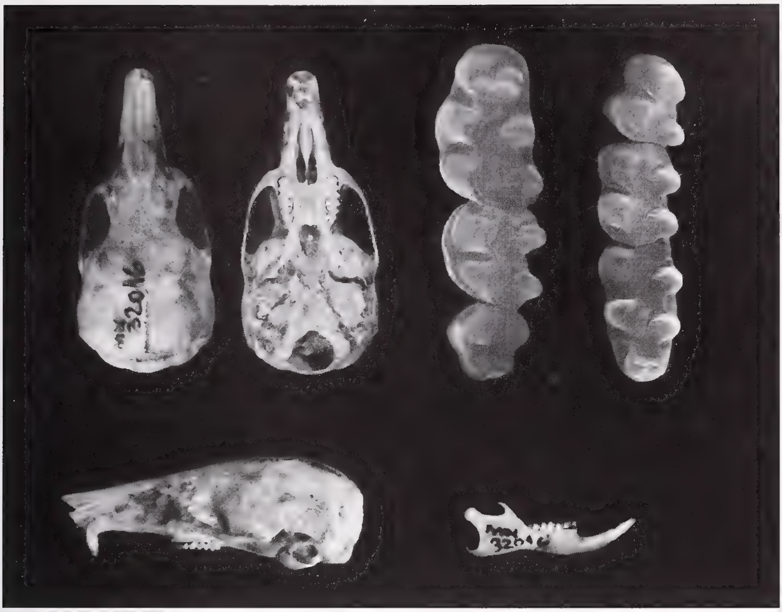


Fig. 23: Gray-bellied Brucie, *Brucepattersonius griserufescens* (holotype MN 32016); skull and molars; GSL, 26.4 mm; molars, 4.5 mm; Terreirão, Parque Nacional de Caparaó, Minas Gerais.

about same as greatest width of braincase; interparietal bone 1.5 x 8.0; incisive foramina extending to first enamel fold (supraflexus) of M^1; palatal bridge produced to posterior plane of M^3; width of mesopterygoid fossa about 2 mm; sphenopalatal vacuity absent; hamular processes of pterygoids destroyed; right auditory bulla, left side braincase damaged; capsular process of lower incisor root weakly pronounced.

Dental. Upper incisor thin, short, orthodont; lower incisor shorter than diastema; anterior median fold of M^1 deep; anterolophule fused with paracone; mesoloph fused with paracone and metacone in M^{1-2}; median fossette present in M^2; m_1 with anteromedian fold; mesolophid present; well developed labiolophulid (*d*) present; ectolophid of m_1 fused with paralophulid; hypoconulid and ectostylid fused in m_1; hypoconulid free in m_3.

Comparisons. Overall size largest of genus; tail, ears longer; underparts dominantly to entirely grayish contrasting with more reddish underparts of *B. igniventris* and *B. soricinus*; underparts as in the much smaller *albinasus* (described below); nasals longer, more slender, interorbital region widest of the genus.

Specimens examined: Total 15. Minas Gerais (Parque Nacional de Caparaó, Terreiraõ, 2400 m, MN 9; Segredo, 2100 m, MN 3; Cachoeira Bonita, 1450 m, MN 1; Pico da Bandeira, 2700 m, MN 1; locality unrecorded, MN 1).

Brucepattersonius albinasus, new species (figs 24, 25, 26) — White-Nosed Brucie

Holotype. Adult female, skin and skull, carcass in alcohol, Museo Nacional, Rio de Janeiro, no. 32017, collected 7 October 1992, by Philip Hershkovitz, Scott M. Lindbergh, Barbara E. Brown and Alfredo Langguth; original number PH 10246.

Etymology. The white triangular rostral patch of this species captures the attention. The white or colorless rostral field is a terminus of the pheomelanic pathway which begins with

Table 9: Measurements of the species and referred specimens of *Brucepattersonius*. First measurement of each taxon is of the holotype.

	iheringi[2] BM 89.9.16.8	*soricinus*[6] (FM 94480)	*igniventris*[8] (MZUSP 27000)	*griserufescens* (MU 32016)	*albinasus* (MN 32017)	Tobunas[9]	Pto. Gisela[9]	Misiones[11]
Head and body	100	110, 103(98–110)6	114, 115, 128	105, 103(93–109)12	88	111, 107	107, 107	103(93–111)7
Tail length	94	74[7], 83(82–85)3	99, —, 93	95[7], 103(97–112)10	100	87, 89	85, 83	86(83–90)7
Hind foot	23.5[3]	26, 25(24–26)6	25, 24, 25	26, 25(24–26)13	25	25, 24	22[3], 23[3]	22(21–24)7[2]
Ear	16	15, 16(15–17)6	16, 16, 18	17, 17.5(16–19)12	17	16, 18	18, 18	18(16–19)7
Weight	—	—	31, 30, 35	23, 23.7(20–27)12	20	—, —	—, —	43(40–45)3
Greatest skull length	27.4[4]	27.8, 27.3(26.5–27.8)4	27.9, —, 28.0	29.2, 29.4(28.8–30.5)11	ca 27.8	29.1, —	29.0, 28.1	29.0(28.1–29.5)6
Condylobasal length	24.7[4]	24.7, 24.7(24.5–24.9)3	25.5, —, 25.2	26.4, 26.1(25.5–27.6)11	ca 24.3	25.5, —	25.3, 24.1	—
Zygomatic breadth	13	12.4, 12.4, 13.1	13.4, —, 13.5	12.7, 12.9(12.4–13.2)10	12.2	13.4, —	12.8, 12.1	13.3(12.8–13.6)7
Interorbital width	6	6.0, 6.0(5.8–6.2)4	6.3, —, 6.0	6.1, 6.2(5.9–6.6)12	6.2	5.8, —	5.8, 5.8	6.0(5.8–6.4)7
Braincase	12.5	12.8, 12.1(11.0–12.8)5	—, 12.7, —	12.9, 12.7(12.4–13.3)11	11.7	12.6, 13.0	12.6, 12.8	—
Nasal length	11	10.8, 10.9(10.1–11.9)4	11.7, —, 12.2	11.8, 11.5(10.1–11.9)12	10.5	12.0, —	11.7, 11.7	—
Incisive foramen	5.2	6.0, 6.0(5.9–6.1)6	6.5, —, 6.3	6.5, 6.4(6.0–6.6)12	6.0	5.5, —	5.6, 5.7	—
Palate, length	—	4.2, 4.1(3.7–4.3)5	4.1, —, 4.2	4.9, 4.4(4.1–4.9)12	4.3	4.7, —	4.8, 4.3	4.6(4.3–4.8)7
Zygomatic plate	—	1.5, 1.7(1.5–2.0)6	1.6, —, 2.0	1.6, 1.6(1.5–1.9)12	1.6	1.5, 1.5	1.8, 1.5	—
Molar row	4.2	4.3, 4.3(4.2–4.4)6	4.5, 4.7, 4.5	4.5, 4.6(4.4–4.9)12	4.4	4.8, 4.4	4.8, 4.6	4.7(4.4–4.9)7
Diasteme	6.8[5]	7.0, 6.6(6.2–7.0)5	7.2, —, 7.0	7.3, 7.5(7.1–8.4)11	6.8	7.1, —	7.0, 6.6	—
Rostrum, width	—	4.9, 4.7(4.6–4.9)6	4.8, —, 4.8	4.6, 4.4(4.0–4.8)12	3.8	4.8, 5.2	4.8, 4.8	—
Naso-int-oct[1]	—	25.0[1]	26.3[1], —, —	26.6[1], —	24.8	—	—	—
Mandible, length	16.8	16.6, 16.4(15.8–16.8)6	17.7, —, 17.0	16.8, 17.8(16.8–19.9)11	16.2	13.3, 13.9[10]	14.0, 14.3[10]	15.9(14.5–16.6)3

[1] Tip of nasals to interparieto-occipital suture of holotypes only.
[2] Taquara, Rio Grande do Sul; original measurements of holotype from Thomas (1896: 308).
[3] without claw
[4] From Philip Myers (personal communication). Original cranial length measurements of holotype by Thomas (1896: 308) are basal, 23; basilar 21.4.
[5] From Philip Myers (personal communication).
[6] São Paulo: Primeiro Morro, 4; Riberão Fundo, 1; Morretinho, 1.
[7] Bobbed tail
[8] Individual measurements in same order throughout: first measurement is of holotype MZUSP 27000.
[9] Misiones, Argentina, from Massoia (1963: 134).
[10] Misiones, Argentina, from Massoia (1963: 134).
[11] From Massoia and Fornes (1969: 320) Tobunas, 2; Dos de Mayo, 3; Puerto Gisela, 2.

Fig. 24: Mustached Brucie, *Akodon mystax* (top), and White-nosed Brucie, *Brucepattersonius albinasus* (bottom).

reddish (e. g., *Wiedomys pyrrhorhinus*), bleaches to yellowish in others (e. g., *Akodon xanthorhinus*), and finally white. The rostral patch may also be blackish (eumelanic) as in *Akodon mystax* described above, and the species of *Oxymycterus* discussed elsewhere (Hershkovitz, 1994).

Type locality. Pico da Bandeira, Parque Nacional de Caparaó, Minas Gerais, Brazil, elevation, 2700 meters.

Distribution. Known only from the type locality in the Parque Nacional de Caparaó. *B. albinasus* and *B. griserufescens* occur together on the Pico da Bandeira at 2700 meters.

Diagnosis. Smallest species of the genus; tail longest, about 114 %, relative to head and body length; general coloration brownish, rostral patch, upper surface of hands, and caudal pencil whitish.

Comparisons. Distinguished from all other species by smaller size, tail longer than head and body combined, and white triangular rostral patch.

Description. Size, smallest of genus; pelage long, fluffy, hairs of middorsum 10—12 mm long; dorsum from head to rump dark brown, sides similar, well defined underparts grayish with thin ochraceous wash, the slaty hair bases showing through; inner surface of limbs like ventrum; hairs of triangular rostral patch, upper surface of hands (fig. 25) and tail pencil whitish, feet grayish, the pale brownish skin showing through; digital and facial vibrissae whitish, the rostral vibrissae laid back reaching ear bases; tail extremely long, about 114 percent of head and body length, brown above, ventral hairs whitish about 5—7 scales long, the scales not hidden; volar pads six; foreclaws thin, weak, length about 2.5 mm, hind claws sturdy, about 3.5 mm.

Cranial. Skull smooth, without crests or ridges; rostrum slender, elongate, length about 40 % percent of skull length; nasal tips rounded, produced slightly less than 1.0 mm beyond incisors, without expansion or formation of trumpet; zygomatic arches weak, hardly expanded beyond sides of braincase; zygomatic plate narrow, sloping back from base, hardly visible viewed from above; interorbital region comparatively wide; braincase subglobular; interparietal about 1.0 x 4.7 mm; incisive foramina long, narrow, terminating slightly posteriad to procingulum of m^1; palate produced slightly behind posterior plane of m^3; greatest width of mesopterygoid fossa 1.7 mm; sphenopalatine vacuities absent; damaged and detached posteroventral portions of braincase including sphenoidal, occipital, mastoidal, and petrous portions too fragmented for accurate description. Mandible slender, smooth, without defined incisor root capsule.

Dental. Molar rows very nearly parallel-sided discounting greater width of first over third molars, opposing cusps oblique.

M^1: Anteromedian fold present; anteromedian style absent; anterolabial conule larger than anterolingual; minute protostyle (*i*) present; minute paralophule (*m*) fused with *i*; absent elements compared with *Oxymycterus nasutus*, include enteroloph (*u*), enterostyle (*x*), plesiostyle (*f*), anteroloph (*h*), mesoloph (*n*), and mesostyle (*o*); short paraflexus (*3*) and metaflexus (*5*) isolated on occlusal surface; median fossette (*a'*) present; posterior fossette (*b'*) indicated by a dot.

M^2: Like M^1 except procingulum reduced, accessories absent; paraflexus (*3*) and protoflexus (*8*) present; median fossette (*a'*) coalesced with paraflexus (*3*); mesoloph (*n*) absent; mesoflexus (*4*) absent or combined with metaflexus (*5*); posterior fossette (*b'*) coalesced with metaflexus (*5*); presence of posteroloph (*t*) indicated by posteroflexus (*6*).

M^3: Worn; subtriangular in outline, less than half size M^2; paracone (*l*), protocone (*v*), hypocone (*y*) raised, metacone (*q*) indicated; paraflexus (*3*) isolated; entoflexus (*9*) well defined.

m_1: Anteromedian stylid (*a*) absent, preflexid (anteromedian fold) (*1*) absent not to be confused with crenulation of anterior enamel margin; supraflexid (*7*) present; labiolophulid (*d*) fused with protoconulid (*j*); protoflexid (*8*) poorly defined; included present are hypoflexid (*10*), paralophulid (*l*), ectostylid (*n*), metaconid (*t*), entoconid (*y*), posterolophid (*r*),

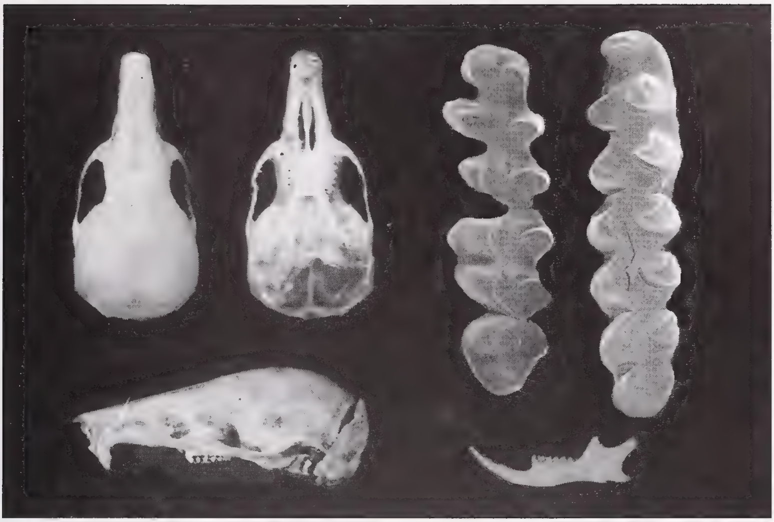


Fig. 25: White-nosed Brucie, *Brucepattersonius albinasus* (holotype MN 32017); skull and molars; GSL, 27.8 mm; molars, 4.4 mm; Pico da Bandeira, Parque Nacional de Caparaó, Minas Gerais.

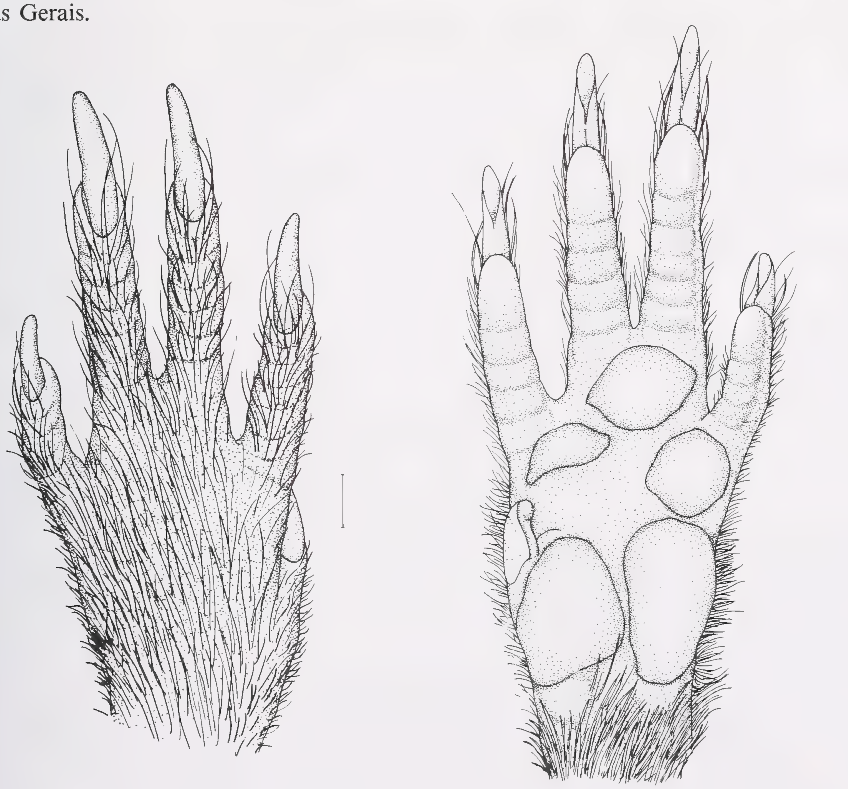


Fig. 26: Left hand of White-nosed Brucie, *Brucepattersonius albinasus* (holotype MN 32017 ♀); A, dorsal aspect; B, ventral aspect.

mesolophid fused with metalophulid and or metaconid; coronal surface with only short isolated mesoflexid (*4*) and posteroflexid (*6*).

m_2: Like m_1 but with reduced procingulid, distoflexid (*11*) less worn, better defined.

m_3: Narrower, shorter than m_2; main cusps well defined; mesoflexus (*4*) isolated, nearly as long as that of m_2 but size may be increased by fusion with adjacent elements.

Measurements. Table 9.

Specimens examined: Total 1. Minas Gerais (Parque Nacional de Caparaó, Pico da Bandeira, 2700 m, MN 1 [holotype]).

Brucepattersonius iheringi Thomas — Ihering's Brucie

Hesperomys nasutus, Hensel (not Waterhouse), 1873: 43, figs 19a, b, 29a, b (molars) — BRAZIL: Rio Grande do Sul.

H[*esperomys*]. *nasutus*, Leche (not Waterhouse), 1886: 700, figs 29—30 (molars) — BRAZIL: Rio Grande do Sul (Taquara do Mundo Novo); cranial and dental characters.

Hesperomys (*Oxymycterus*) *nasutus* (not Waterhouse), Ihering, 1892, Anuario do Estado do Rio Grande do Sul, para 1893. 9: 109 — BRAZIL: Rio Grande do Sul (Taquara do Mundo Novo).

Oxymycterus iheringi Thomas, 1896: 308; description. Thomas 1902: 62 — BRAZIL: Paraná (Roça Nova, Serra do Mar, 1000 m); coloration.

Oxymycterus iheringi, Massoia 1963a: 129 (part) — comparisons; taxonomic history of holotype. Massoia & Fornes 1969: 315 (part) — taxonomic history of holotype. Musser & Carleton 1993: 727 — taxonomic comments.

M[*icroxus*]. iheringi, Thomas 1909: 237 — reclassification.

Microxus (?) *iheringi*, Gyldenstolpe 1932: 134 — characters; taxonomy.

[?] *Microxus iheringii* [sic] Vieira 1953: 145 — BRAZIL: Rio Grande do Sul (São Lourenço); São Paulo (Campos do Jordão); characters [measurements of male not of *O. iheringi* — PH]. Massoia 1963: 135 — Vieira identifications questioned.

Akodon (*Microxus*) *iheringi*, Cabrera 1961: 458 — classification; distribution.

Holotype. Female, skin and skull, British Museum (Natural History) no. 86.9.16.8; collected by Hermann von Ihering.

Type locality (fig. 1). Rio dos Linos (sic = Sinos), Taquara do Mundo Novo, Rio Grande do Sul, Brazil, 29°39'S, 50°47'W; 29 m.

Distribution. Forested parts of southeastern Brazil in the states of Rio Grande do Sul, Paraná and perhaps São Paulo.

Diagnosis (from literature). Size small, upper parts and sides grayish, underparts undefined from sides; tail nearly as long as head and body combined.

Characters. *Oxymycterus iheringi* Thomas is virtually unknown apart from the original description and some bibliographic references. The specimens from Misiones, Argentina, described by Massoia (1963), and by Massoia and Fornes (1969), as surrogates for true *iheringi*, do not agree with that species in coloration, size and perhaps other characters. Measurements are reproduced here (table 9), details of color are quoted, and mentioned in the discussion of the Misiones material. The original Thomas description of *iheringi* and his other contributions are reproduced as follows.

"***Oxymycterus Iheringi***, sp. n." [Thomas, 1896: 308]

"Much smaller, more slenderly built, and less Oxymycterine than *O. nasutus, rufus,* and the other more typical species. Fur soft and thick. General colour uniform grizzled brown, scarcely paler below. Eyes not unusually small. Ears fairly large, thinly haired, brown. Claws much less lengthened than in *O. nasutus*, but still with the essential fossorial structure characteristic of the group; pollical claw short. Fifth hind toe decidedly longer than the hallux, reaching to the level of the base of the fourth toe. Tail almost as long as the head and body, slender, thinly haired, brown above, rather paler below. Mammae 1—2 = 6.

"Skull not specially elongated anteriorly, although the muzzle shows something of the characteristic *Oxymycterus* structure. Supraorbital edges smoothly rounded. Interparietal and anterior zygoma-root and other details very much as in *O. nasutus*, in spite of the great difference between the two in the general proportions of the skull.

"Dimensions of the type (an adult female in spirit)," [are reproduced in table 9].

"The two specimens of this species in the Museum are part of the large collection of Taquara rodents worked out by Dr. Leche [footnote, 'Zool. Jahrb. i. p. 700 (1886)'.], by whom the present animals were called *Oxymycterus nasutus*, under which name they have remained in the Museum collection until now. Among other rodents collected by Dr. von Ihering at San Lorenzo, in the same province, there are specimens undoubtedly referable to the true *O. nasutus*; but these two from Taquara, and no doubt the others seen by Dr. Leche, are so different that there can be no question as to their specific distinction [footnote, 'Dr. Leche says that of nineteen skulls examined by him the largest had a basilar length of 22 millim. The basilar length of the true *O. nasutus* is from 27 to 29 millim.']. Dr. Leche was no doubt led astray by Hensel, in whose classical paper on the mammals of Rio Grande do Sul [footnote, 'Abh. Ak. Berl. 1872: 43'] the species now described is also referred to *O. nasutus*. Hensel's account must therefore in future be assigned to *O. Iheringi*, to our knowledge of whose structure and habits he makes some valuable contributions. The difference between the two forms is so great that it is difficult at first sight to realize that *O. Iheringi* is an *Oxymycterus* at all, as it is quite without the extraordinary trumpet-shaped muzzle possessed by *O. nasutus* and its allies. Probably it is most nearly related to Winge's *O. talpinus* [footnote, 'E Museo Lundii, iii. p. 36 (1887)'.], as yet only known fossil from Lagoa Santa, but has rather a shorter head and shorter palatine foramina; so that I have not been able to assign it to the fossil form, as in the case of the animal next to be described."

In a report of a male from Serra do Mar, Paraná, Thomas (1902: 62) noted that "this is the first skin . . . of *O. Iheringi* which I have seen, the original series all having been in spirit. The general colour should rather have been described as grey than brown."

In 1909 (p. 237) Thomas referred *iheringi* to his newly erected genus *Microxus*.

The specimens of *O. iheringi* collected by Hensel (1872: 43) in Rio Grande do Sul and recorded as *Hesperomys nasutus* include 2 skeletons, 2 skulls and 1 or 2 entire in spirits. His measurements of basilar length of the smaller of the two skulls was 20.0 mm, upper molar row 4.1 ($M^1 = 2.0$, $M^2 = 1.30$, $M^3 = .90$). Measurements of the larger skull were basilar length 22.2; nasals 12.5; incisive foramen 5.3; interorbital width, 6.1; interparietal, 1.4 x 7.7; mandibular depth below m_1 2.7, below m_2 2.3. Vertebral count of the skeleton was 12 thoracic, 7 lumbar, 20 caudal.

Measurements of a male identified by Vieira (1953: 145) as "*Microxus iheringi*," provenance unspecified, appear to be those of *Oxymycterus nasutus*. In all likelihood other specimens Vieira recorded at the same time under the same name, one from São Lourenço (no. 572), and two females from Campos do Jordão (nos. 2073-74), are likewise referrable *to O. nasutus*. Notwithstanding, they are listed in the above synonymy of *O. i. iheringi* as possible sympatriots in hypothetical northern and southern extensions of its geographic range.

Specimens examined: None.

Brucepattersonius sp. (Misiones, Argentina)

Oxymycterus iheringi, Massoia (not Thomas) 1963: 129, figs 1—4 (skull) — ARGENTINA: Misiones (Tobunas, Ruta 14, km 352; Puerto Gisella, Río Paraná); characters; comparisons; taxonomy; habitat. Massoia & Fornes 1969: 315, fig. 1 (animal), fig. 2 (palate), fig. 3 (molars); ARGENTINA: Misiones (Tobunas; Dos de Mayo; Puerto Gisella); taxonomic history; characters; comparisons.

The Misiones, Argentina, sigmodontines identified with typical Rio Grande do Sul *Oxymycterus iheringi* Thomas, are apparently congeneric judged by the descriptions and illustrations published by Massoia (1963), and Massoia & Fornes (1969), but not likely conspecific. Massoia's (1963: 133) description of the four Misiones specimens he recorded follows, freely translated from Spanish.

"This is a small species of *Oxymycterus* with comparatively short claws, the length in a straight line between 2.3—2.6 mm; pelage soft, general coloration of dorsal surface approxi-

Table 10: Original measurements of *Oxymycterus rufus* compared with hocicudos from selected localities. All measurements by the author except as noted.

	Head & Body	Tail	Hind foot	Condylobasal	Molar Row
32° South[1]	135[1]	135 [95]	35.2[1]	—	—
Delta Parana[2]	153(134–189)4	95(94–96)4	30(29–31)4[8] 25(22–27)4[8]	32.3(30.6–34.6)3	5.2(5.2–5.3)4
Delta Parana[3]	153(139–180)6	93(86–97)6	25.8(23–27)6	—	5.3(5.2–5.6)6
Caparaó[4]	152(139–165)7	129(114–151)3	35(32–37)7	34.4(32.6–36.5)7	5.7(5.5–5.8)7
Primeiro Morro[5]	161(154–173)8	122(117–129)8	35(35–36)8	–(35.2)1	5.6(5.5–5.9)8
Caraguatay[6]	167(164–179)5	131(123–135)5	37(34–38)5	37.4(36.9–38.2)3	5.5(5.2–5.6)5
Iporanga[7]	174(150–186)5	136(111–148)3	36(32–38)7	36.6(34.8–38.0)7	5.9(5.7–6.1)7

[1] Entre Rios, Argentina, type locality of *Oxymycterus rufus*; data from Azara 1802; Old French measurements converted to metric system: Total length 8 1/2", less tail 3 1/2" = 132 mm; second specimen, total length 9 1/2" = 250 mm, tail length not given; hind foot to tip of longest claw, 13"' = 35.2
[2] Buenos Aires, Argentina; Pereira, 1 (FM); Punta Lara, 3 (FM).
[3] Buenos Aires, Argentina; Measurements from Massoia (1961).
[4] Minas Gerais, Brazil (FM); tentatively *O. rufus*.
[5] São Paulo, Brazil (FM).
[6] Misiones, Argentina (FM).
[7] São Paulo, Brazil (FM); tentatively *O. hispidus*.
[8] In dry skin; with claw and without claw.

mately dark ochraceous "pardusca ochracea" "(YYO-6-3°)," gradually passing into a grayish brown ("amarillo pardusco pálido") "(YYO-17-5°)" on belly, all hair bases being plumbeus gray "(C-6-1°)."

Massoia & Fornes (1969: 319) described the dorsal surface of 7 Misiones specimens (including the foregoing) as a mixture of grayish chestnuts and yellows ("castaños, grisaceos y amarillos") "(0-5-7)." The color terms used are from the "Atlas de Villolobos Domingues y Villalobos." The "Atlas" is not available but the color terms are standard.

Cranial characters were said by Massoia (1963: 173) to be similar to those of adult *Oxymycterus nasutus* except smaller. The nasals of four specimens (Pto. Gisela, 2; Tobunas, 2) were described as completely fused except for about 1/3 their length, a character not seen before in sigmodontines.

The crown surfaces of upper and lower molars of the Tobunas mice were figured by Massoia & Fornes (1969: 318) in comparison with those of *Oxymycterus nasutus*. The peculiar nasal character was not mentioned.

The two Tobunas mice recorded by Massoia were trapped at night in wooded areas, one on the border of a rocky stream, the other in a low brushy area on the edge of a pathway.

Measurements. Table 9.

Specimens examined: None.

Oxymycterus Waterhouse

Type species *Mus nasutus* Waterhouse, 1837: 16, by original designation.

Oxymycterus rufus Fischer (fig. 27)

Mus rufus Fischer, 1814: 71.

Holotype. Not known to exist; name based solely on the description of the rat cinquième ou rat roux of Azara (1801(2): 94).

Type locality. 32°30'S, Rio Paraná = Entre Ríos, Argentina (cf. Hershkovitz 1994: 35).

The large reddish hocicudo ("long nosed" in Spanish) of Paraguay, Uruguay, the Argentine provinces of Entre Rios and Buenos Aires, and the Brazilian states of Rio Grande do Sul and Santa Catarina, have generally been identified as *Oxymycterus rufus* Fisher. Other named large hocicudos of the same regions are *O. misionalis* Sanborn (1931) from Misiones, Argentina, *O. judex* Thomas (1909) from Santa Catarina, and *O. quaestor* Thomas (1903) from Paraná. All three have since been treated as subspecies of the Bahian *O. hispidus* (fig. 28) by Cabrera (1961: 467), and as outright synonyms of *O. hispidus* by Musser & Carleton (1993: 727). *Oxymycterus hispidus* from Bahia, described by Pictet in 1843, is known from the original description only. The holotype, if extant, awaits comparison with any of its referred conspecifics, or with a topotype or near topotype of *O. rufus*, which lacks a type specimen.

Coloration of the hocicudo as described by Azara in the Spanish edition (1802: 80) as canela or cinnamon, a hue which could apply to any reddish hocicudo and to most specimens of the localities listed in table 9.

Measurements given by Azara in the original description of *O. rufus* and reproduced in table 9, agree best with those of the mouse from the Delta Paraná, Argentina (table 10) except that hind foot length is much too large. However, total length of the larger of the two hocicudos measured by Azara brings other extrapolated dimensions into line with those of the larger individuals listed in the same table. The name *Oxymycterus rufus* Fisher, therefore, is the earliest available for the species. The Delta Paraná hocicudos with short hind feet may not be *Oxymycterus rufus*. The large hocicudos from Caparaó, Primeiro Moro, Iporanga, and Caraguatay may not be conspecific but cannot be shown to be either *O. rufus* (fig. 27) or *O. hispidus* (fig. 28). They are much larger than the next described hocicudo.

Measurements. Table 10.

Specimens examined. Total 17. São Paulo (Petar, Iporanga, 8 MZUSP); Espírito Santo (Parque Nacional de Caparaó, Pedra Roxa, 6 MN); Minas Gerais (Parque Nacional de Caparaó, Cachoeira Bonita, 1 MN; Vale Verde, 1 MN); locality unrecorded, 1 MN.

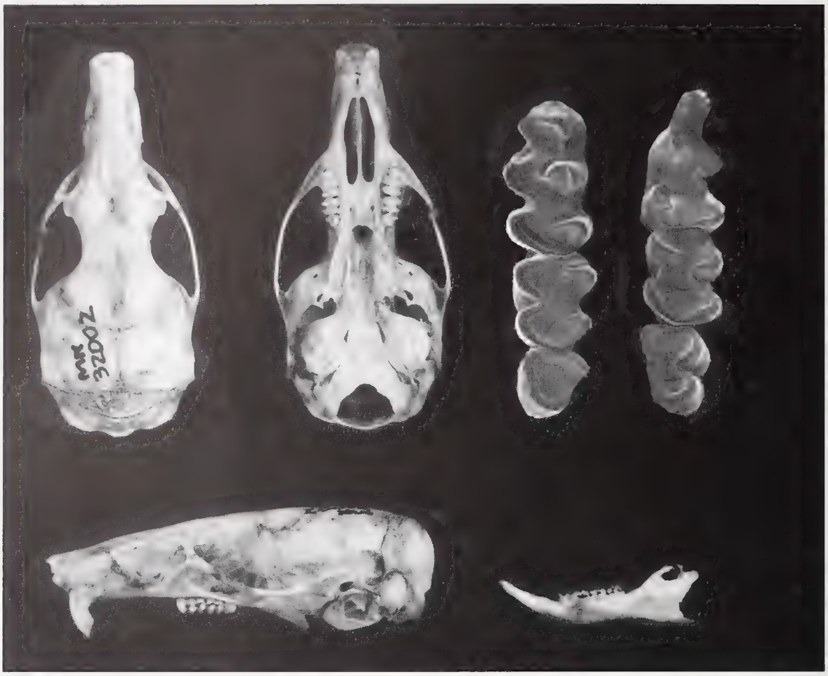


Fig. 27: Azara's Rufus Hocicudo *Oxymycterus rufus* (MN 32002 ♂); skull and molars; GSL, 35.8 mm; molars, 5.5 mm; Pedra Roxa, Pico da Bandeira, Parque Nacional de Caparaó, Espírito Santo.

Oxymycterus caparaoe, new species (fig. 29, 30)

Holotype. Adult female, skin and skull, MN no. 31997, collected 25 October, 1992, by Philip Hershkovitz, Scott M. Lindbergh, Alfredo Langguth and Barbara E. Brown, original no. 10426.

Type locality. Arrozal, Parque Nacional de Caparaó, Minas Gerais, Brazil, elevation 2400 m.

Distribution. Known only from the western slope of the Pico da Bandeira, Parque Nacional de Caparaó, Minas Gerais.

Diagnosis. A small, dark brown hocicudo with orange underparts, and long, slender, trumpet-shaped nasals.

Characters. External. Upper surface of body dominantly dark brown modified agouti, pelage thick, long, lax, about 1 cm long on dorsum; individual hairs with tip blackish, the single orange subterminal band minute; basal portion of hairs slate color; sides of body more orange, the subterminal pheomelanin band wider; underparts orange but with slaty basal portion of hairs showing through, the broad ventral midline stripe from throat to anus nearly entirely orange; ears moderately large, pinna dark brown; cheiridia long, narrow blackish above and below each with 6 plantar pads; manual claws longer than pedal claws; manual digit III with claw 7.9 mm, digit IV with claw 5.8 mm, adjacent digits shorter, digit I vestigial, claw, 2.5; digit V, not reaching base of IV, with claw 2.3, reaching phalanx 1; pedal digit I extending to base of II, with claw to base of phalanx 2 of II, digit V about same; claw I, 3.2 mm;

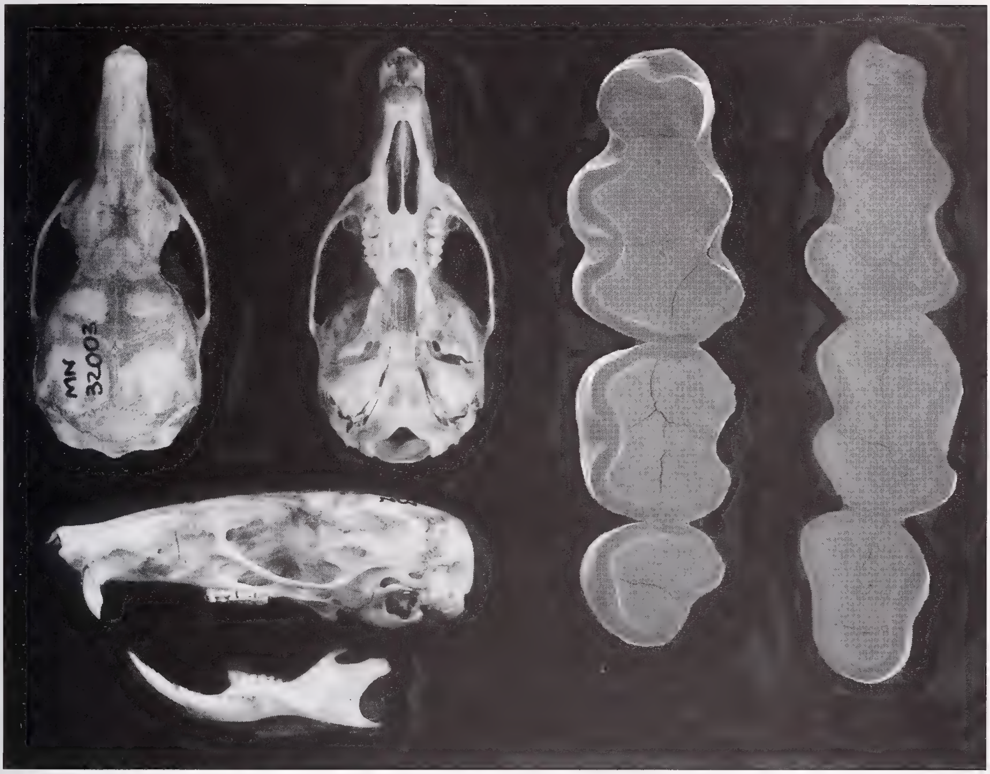


Fig. 28: Hispid Hocicudo, *Oxymycterus hispidus* (MN 32003).

II, 3.8; III, 4.0; IV, 3.8; V, 3.6; interdigital webbing present between second phalanges of digits II, III, IV; tail uniformly dark brown, scutular hairs short, those of underside longer but not concealing scales. Mammae 1-2 = 6.

Cranial. Dorsal contour of skull gently sloping; rostrum elongate, nasals with premaxillary bones parallel-sided, their combined tips slightly trumpet-shaped; zygomatic arches slender, zygomatic plate visible when viewed from above; frontal sinuses little inflated; temporal ridges weak; well defined interparietal bone small (3 x 9.2 mm); incisive foramina (1.7 x 6.9) extending slightly behind level of metacone of M^1; posterior palatal border level with posterior border of last molars; mesopterygoid fossa wide (1.8 mm).

Dental. Incisors orthodont, combined cutting edges plane; molars tetralophodont, hypsodont, the cusps opposed, worn crowns deeply dished, 8-shaped; M^1 with anterior median flexus, M^3 small, the attenuated metacone and hypocone barely distinguishable from each other; lower molar crowns as worn as uppers, opposing cusps oblique; anterior median flexus present; mesolophid, ectolophid and protocunulid defined in m_{1-2}; m_3 nearly twice as large as M^3.

Measurements. Table 11.

Comparisons. *Oxymycterus caparaoe* can be distinguished by smaller size alone from larger sympatric *Oxymycterus rufus* or *O. hispidus*. It is separated from the similar sized southeastern Brazilian *O. nasutus* Waterhouse (1837) (fig. 30) by paler coloration (table 12) and more projecting rostrum. Comparative morphometrics are in table 11.

Table 11: *Oxymycterus caparaoe* and *Oxymycterus nasutus* compared: measurements are means, extremes, sample number.

	Holotype	*caparaoe*[1]	*nasutus*[2]	*nasutus*[3]
Head and body	125	126(110−139)28	125(110−137)5	129(114−141)9
Tail	91	93(80−104)22	86(79−90)5	85(72−91)9
Hind foot	27	27(24−29)27	27.6(27−28)5	23[4](22−24)9
Ear	18	19(17−21)27	—	17(16−19)9
Gr. skull length	34.3	34.4(32.9−35.9)15	32.2(30.3−33.4)3	32.8(31.5−34.5)3
Condylobasal length	30.7	30.3(28.6−31.7)16	29.9(28.8−31.1)5	—
Zygomatic breadth	13.8	13.9(13.6−14.4)9	14.1, 14.2	14.0(12.7−15.0)3
Interorbital width	5.7	5.9(5.5−6.4)22	5.5(5.3−5.7)5	5.8(5.5−6.1)3
Braincase width	13.7	13.8(12.9−14.5)16	13.0, 13.6	—
Nasal length	12.0	12.9(11.4−14.5)16	13.0(13.3−14.2)3	12.1(11.5−12.7)3
Incisive foramina	7.0	6.8(6.5−7.2)19	7.1(6.9−7.3)3	—
Rostrum width	4.3	4.5(4.0−5.0)21	—	—
Zygomatic plate	2.3	2.1(1.6−2.4)18	2.1(2.0−2.1)3	—
Diastema	7.9	7.9(7.3−8.8)18	7.5(7.3−7.5)3	—
Molar row	4.8	4.7(4.5−5.5)19	4.8(4.7−4.8)3	4.7(4.6−4.9)3

[1] HB = Head and body; [2] with claw; [3] from notch; [4] CL = Condylobasal length; [5] ZB = Zygomatic breadth; [6] IB = Interorbital breadth; [7] BW = Braincase width; [8] NL = Nasal length; [9] IF = Incisive foramen; [10] PL = Palatal length; [11] UM = Upper molar row; [12] D = Diastema; [13] R = Rostral breadth; [14] W = Weight, grms; [15] ZP = Zygomatic plate.

Table 12: Phenotypes compared of *Oxymycterus caparaoe* (type series) and *O. nasutus* topotypes.

Character	*caparaoe*	*nasutus*
1. Dorsum	Dominantly dark brown (eumelanic) modified agouti	Dominantly ochraceous (pheomelanic) modified agouti
2. Underparts	Saturate orange (pheomelanic) with basal gray showing through	Dilute orange (pheomelanic) with basal gray showing through
3. Sides of trunk and head	Dark brown like back or slightly paler	Nearly or entirely uniformly orange
4. Crown	Darker than back	Orange like back
5. Tail	Uniformly blackish	Bicolor; pale brown above; distinctly paler beneath
6. Hind feet	Blackish above and below	Pale above, nearly colorless beneath
7. Ears	Dark brown	Ochraceous

Dimensions of Andean Division size groups of hocicudos are roughly comparable to those of the Atlantic Division (cf. Hershkovitz 1994). The small Andean *O. hiska* and *O. hucucha* are smaller than any Atlantic Division hocicudo, the large *O. inca* parallels members of the

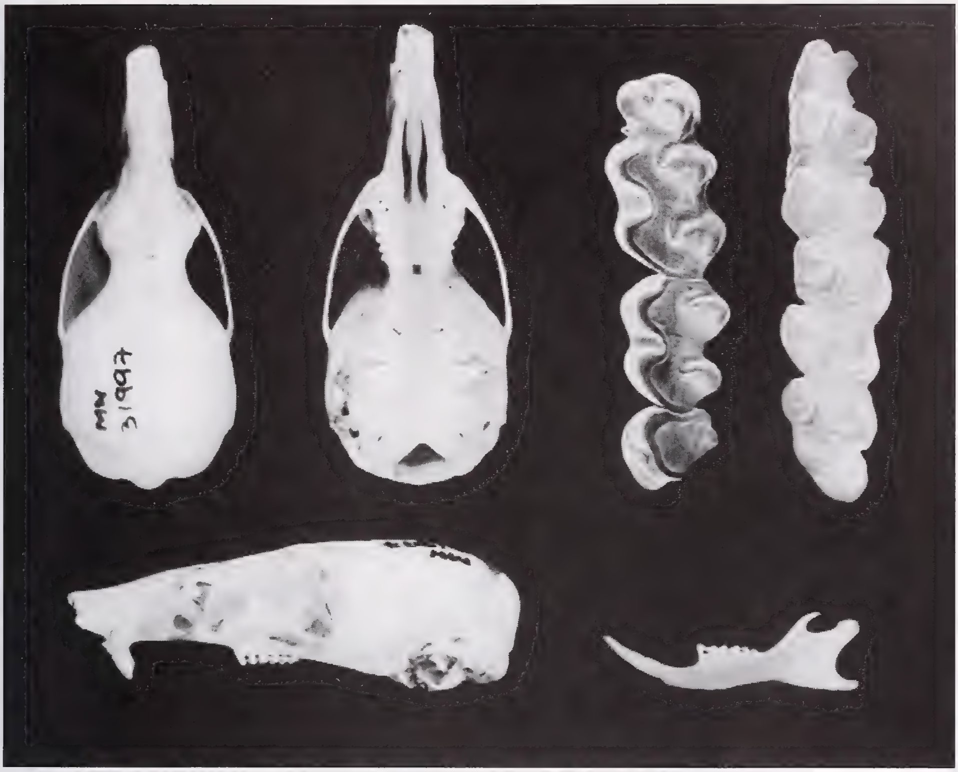


Fig. 29: Mt. Caparaó Hocicudo *Oxymycterus caparaoe* (holotype MN 31997 ♀); skull and molars; GSL, 34.3 mm; molars, 4.5 mm; Arrozal, Pico da Bandeira, Parque Nacional de Caparaó, Minas Gerais.

O. rufus-hispidus group, and those of the medium-size *O. paramensis* group equate with the medium and intermediate-size *O. nasutus-O. caparaoe* group. Morphometrics of *O. paramensis, O. nasutus,* and *O. caparaoe* are virtually the same but *O. caparaoe* is intermediate in coloration, *O. paramensis* being the paler.

Most cranial differences between *O. caparaoe* and *O. paramensis* vary randomly from population to population. The consistently different traits of *O. paramensis* include shorter, less protrusive rostrum, the condition reflected in shorter cranial length and incisive foramina. Other distinctions include narrower mesopterygoid fossa, and more inflated frontal sinuses (fig. 30).

Remarks. The obvious difference between *O. caparaoe* and *O. nasutus* is the dark brown or dominantly eumelanin outer parts of the first and the dominantly pale reddish or orange pheomelanin outer parts of the second. Expansion of the pheomelanic band of the agouti hairs in *O. nasutus* with corresponding decrease in width of the eumelanic band are derived conditions. Descriptions of *O. nasutus* have been provided by Vieira (1953), and Gyldenstolpe (1932).

Range of chromatic variation in *O. caparaoe* is extremely narrow and the probability that the species may be dichromatic or that it intergrades with the paler *O. nasutus* seems unlikely.

Fig. 30: Mt. Caparaó Hocicudo *Oxymycterus caparaoe* (MN 31997 ♀); A, skull; B, molars; GSL 34.3 mm; molars, 4.5 mm; Arrozal, Caparaó, Minas Gerais; compared with *Oxymycterus nasutus* (FM 27652 ♂); C, skull; D, molars; GSL, 33.3 mm; molars, 4.7 mm; Uruguay: San José, S. Ecilda.

The originally forested habitat of *O. caparaoe*, is now second growth and scrub. That of *O. nasutus* is scrub and/or savanna.

Table 13: Skeletal measurements and ratios x 100.

	Greatest Skull Length	Humerus	Ulna	Ulna Humerus	Femur	Humerus Femur	Tibia	Tibia Femur	Ulna + Humerus Tibia + Femur	Pelvis Greatest Length	Trunk	Femur Trunk	Ulna + Humerus Trunk	Tibia + Femur Trunk	Pelvis Trunk	Humerus Trunk	Ulna Trunk
Oxymycterus rufus																	
MN 32005	38.7	20	—	—	29	69	—	—	—	37	90	32	—	—	—	22	—
O. roberti																	
PH 9569	34.6	17	21	23	25	68	26	104	74	30	80	31	47	64	37	21	26
O. caparaoe																	
MN 31984	35.3	16	—	—	22	73	—	—	—	26	89	25	—	—	29	17	—
MN 31985	—	15	—	—	20	75	—	—	—	25	75	27	—	—	33	20	—
MN 31986	34.7	15	—	—	21	71	—	—	—	25	76	28	—	—	32	20	—
Brucepattersonius griserufescens																	
MN 32236	29.2	13	—	—	21	62	—	—	—	19	86	24	—	—	22	15	—
Delomys sublineatus																	
FM 141628	—	16	17	—	22	73	25	—	—	23	—	—	—	—	—	—	—
FM 141629	—	17	19	—	22	77	26	—	—	26	88	25	—	—	29	19	—
Delomys dorsalis																	
PH 10029	—	19	—	—	24	79	—	—	—	28	90	27	—	—	31	20	—
Thaptomys nigrita																	
MN 32175	33.9	12	—	—	13	92	—	—	—	18	47	28	—	—	38	25	—

Specimens examined: Total 30. Minas Gerais (Parque Nacional de Caparaó, Segredo 2100 m, MN 1; Vale Encantado, 1980 m, MN 17; Arrozal, 2300—2400 m, MN 7; Terreirão, 2400 m, MN 9; station unrecorded, MN 5).

Fig. 31: Diagrams of right and left upper molar crown patterns.

Explanation for symbols. Note: a—i inclusive = procingulum or loph I; s, t, z = postcingulum or loph V.

I—V. lophs of pentalophodont molars
a. anteromedian style (may be fused with b, c, or both)
b. anterolabial lophule
c. anterolingual lophule
d. anterolophule (may be fused with f)
e. anterior fossette
f. plesiostyle (may be fused with d, h, or j)
g. protostyle (may be fused with i)
h. anteroloph (may be fused with f, j, or both)
i. protoloph (may be fused with g, u, or both)
j. parastyle (may be fused with f, h, k, or a combination)
k. mesolophule (may be fused with h, j, or both)
l. paracone
m. paralophule (may be fused with n, o, or both); element may be multiplied
n. mesoloph (when fused with o = mesolophostyle)
o. mesostyle (may be fused with m, p, or both; when fused with n = mesolophostyle
p. metalophule (may be fused with o, n, or both)
q. metacone
r. posterolophule (may be fused with s)
s. posterostyle (may be fused with r, t, or both)
t. posteroloph (may be fused with s)
t'. posteroconule (may be fused with z, usually not differentiated from posteroloph, t)
u. protolophostyle (may be fused with i)
v. protocone
w. enteroloph (may be fused with x)
x. enterostyle (may be fused with w)
y. hypocone
z. distostyle
a'. median fossette (may be coalesced with 3, or united with 4)
b'. posterior fossette (may be coalesced with 5, or united with 6)
c'. protolophule
d'. hypolophule
e'. mure (border between lingual and labial cusps and lophs)

1. preflexus (anterior median fold)
2. anteroflexus (anterior secondary fold)
3. paraflexus (first primary fold)
4. mesoflexus (first secondary fold)
5. metaflexus (in absence of mesoloph [n] coalesced with first secondary fold [4])
6. posteroflexus (second secondary fold)
7. supraflexus (anterior lingual fold; in absence of protoloph coalesced with first minor fold [8])
8. protoflexus (first minor fold)
9. entoflexus (major fold)
10. hypoflexus (in absence of enteroloph coalesced with major fold [9])
11. distoflexus (second minor fold)

Skeleton

Bone measurements and ratios of the species of this report were intended to reflect locomotor and functional adaptations. It was found, however, that in most of the few available skeletons, distal ends of the long limb bones had been truncated and left with the foot bones in the prepared study skins (table 13). Convincing interpretations of form and function could not be derived from the partial data but the four complete proximal limb bones are instructive. *Thaptomys* with its extremely long humerus (humerus/femur) is fossorial. In contrast, the comparative length of the *Oxymycterus* humerus to femur does not indicate adaptation for digging.

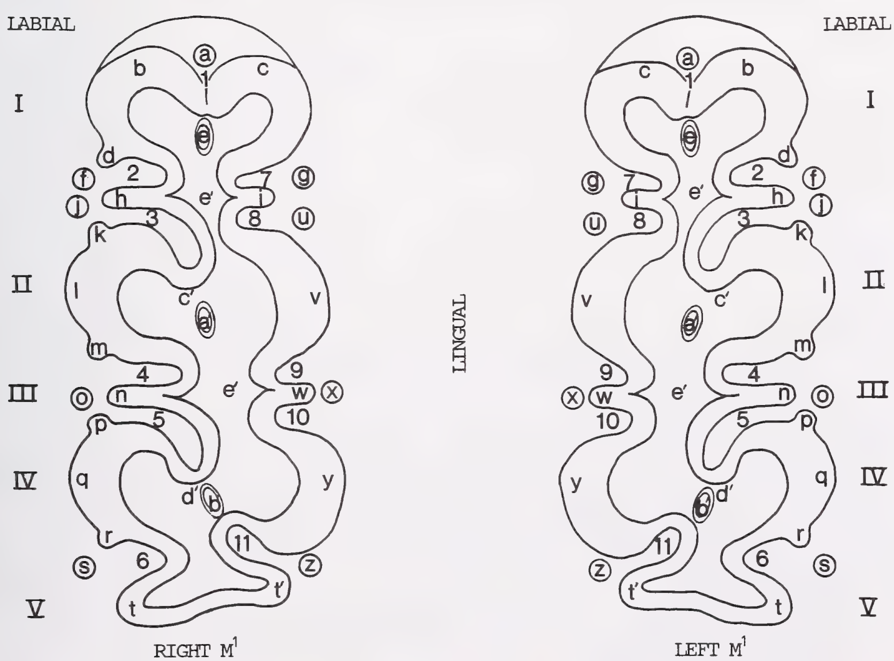
The vertebral count of the genera examined is the expected 7 cervical, 13 thoracic (rarely 12 or 14), 5 or 6 lumbar, sacrals 2 (*Thaptomys*), 3—6 (*Oxymycterus*), 2—3 (*Delomys*).

The entepicondylar foramen is absent in all sigmodontine species examined.

Articulation of the first rib may be with the first thoracic vertebra, the 7th cervical vertebra, or with both.

Sympatry

All individuals of the same genus living on the western or Minas Gerais slope of Mt. Caparaó from 1100 m upwards to the peak at approximately 2700 m, are regarded as sympatric. The congenerics actually taken in the same trapping stations are *Akodon mystax* and *A. serrensis* from Terreirão and Pico da Bandeira, and *Oxymycterus rufus* and *O. caparaoe* from the same two stations; *Brucepattersonius griserufes-*



cens and *B. albinasus* were trapped at Pico da Bandeira. Each of the remaining species of this report may not have a congeneric in the Parque de Caparaó or it remains to be discovered.

Fig. 32: Diagrams of right and left lower molar crown patterns.

Explanation for symbols. Note: a—h inclusive = procingulid or lophid I; a', r, r' = postcingulid or lophid V.

I—V. lophids of pentalophodont molars
a. anteromedian stylid (may be fused with b, c, or both)
b. anterolabial conulid (may be fused with c)
c. anterolingual conulid (may be fused with b)
d. labiolophulid (may be fused with g)
e. anterior fossette
f. anterolophulid (may be fused with h, i, or both)
g. prostylid (may be fused with d)
h. anterolophid (may be fused with f, i, s, or combination)
i. anterostylid (may be fused with f, h, s, or combination)
j. protoconulid (may be fused with g)
k. protoconid
l. paralophulid (may be fused with m, n, or both)
m. ectostylid (may be fused with l, n, o, or combination)
n. ectolophid (may be fused with l, m, o, or combination)
o. hypoconulid (may be fused with m or n)
p. hypoconid
q. posterolophulid (may be fused with r')
r'. posterolophid (may be fused with q)
r. posteroconulid (usually not differentiated from posterolophid, r')
s. mesolophulid (may be fused with h)
t. metaconid
u. metalophulid (may be fused with v, w, or both)
v. mesolophid (when fused with w = mesolophostylid)
w. mesostylid (when fused with v = mesolophostylid)
x. entolophulid (may be fused with v, w, or both)
y. entoconid
z. distolophulid (may be fused with a')

a'. posterostylid
b'. median fossetid
c'. posterior fossetid
d'. protolophulid
e'. hypolophulid
f'. murid (zone between lingual and labial lophids and cuspids)

1. preflexid (anterior median fold)
2. anteroflexid (anterior lingual fold; in absence of anterolophid [h] coalesced with 3)
3. metaflexid (first secondary fold)
4. mesoflexid (first primary fold)
5. entoflexid (second secondary fold; in absence of mesolophid [v], coalesced with 4)
6. posteroflexid (second primary fold)
7. supraflexid (anterior labial fold; in absence of labiolophulid [d] coalesced with 8)
8. protoflexid (first minor fold)
9. ectoflexid (major fold)
10. hypoflexid (in absence of ectolophid [n] coalesced with 9)
11. distoflexid (second minor fold).

Dental patterns

Patterns of the sigmodontine upper and lower first molar crowns are shown diagrammatically in figures 31 and 32. The terminologies for the dental elements follow. The same diagrams serve for the identification of the enamel elements and folds or flexi (ids) of all muroid molars.

Lettering and numbering of dental elements for right and left upper and lower molars are the same but reversed. Because of differences between stationary upper and moving lower molars the symbols are not the same for most apparently homologous upper and lower elements. Numbers for the enamel folds or flexi (ids) remain the same for upper and lower molars but reversed for right and left.

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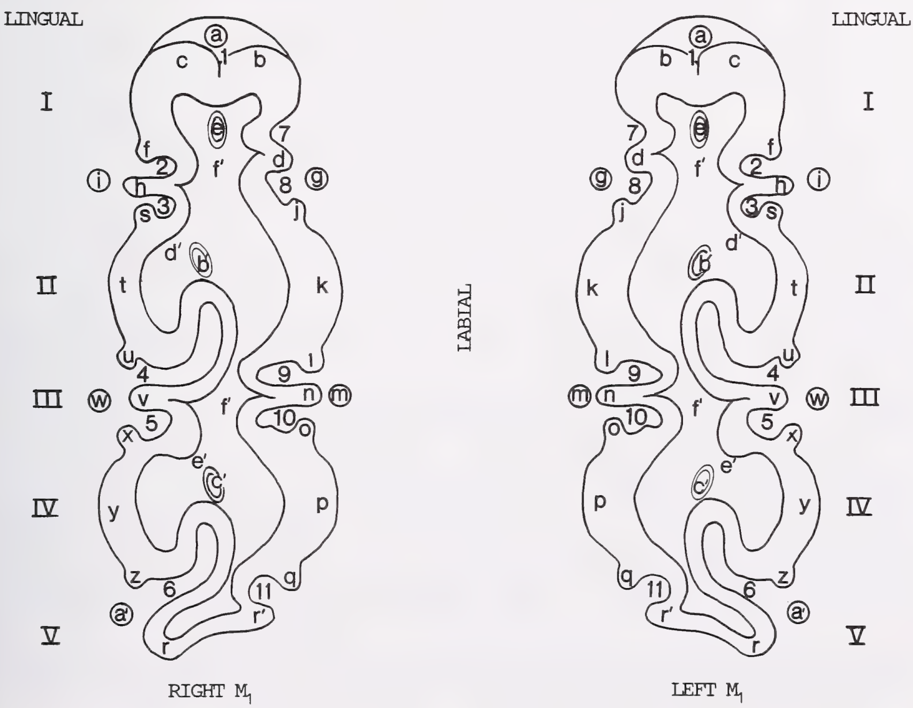

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Zusammenfassung

In diesem Report wird über einen Teil der Aufsammlungen von Kleinsäugern im Iporanga State Park, São Paulo, im Parque Nacional de Caparaó, Minas Gerais-Espírito Santo, und an einigen Lokalitäten in Südost-Brasilien, die nicht vom Vefasser selbst besucht wurden, berichtet. Beschreibungen werden gegeben von fünf Gattungen (davon eine neu) und 14 Arten (6 neue, 1 noch unbeschrieben) sigmodontiner Nagetiere. Zwei frühere Berichte von anderen Autoren über Säugetiere des Caparaó National Park werden kritisch besprochen.

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A biochemical and morphological investigation of *Suncus dayi* (Dobson, 1888) and discussion of relationships in *Suncus* Hemprich & Ehrenberg, 1833, *Crocidura* Wagler, 1832, and *Sylvisorex* Thomas, 1904 (Insectivora: Soricidae)

Paulina Jenkins, Manuel Ruedi, and François M. Catzeflis

Abstract. A recent field expedition in South India yielded a series of seven specimens of *Suncus dayi* (Dobson, 1888), a poorly known crocidurine shrew collected in high-altitude wet evergreen forests in the Nilgiri Hills. The morphology (external, cranial, dental) of this species was investigated in a comparative study with a few taxa of the genera *Suncus* Hemprich & Ehrenberg, 1833 (e.g. *S. stoliczkanus* (Anderson, 1877), *S. fellowesgordoni* Phillips, 1932), *Sylvisorex* Thomas, 1904 (e.g. *S. morio* (Gray, 1862), *S. granti* Thomas, 1907 group) and *Crocidura* Wagler, 1832 (e.g. *C. attenuata* Milne-Edwards, 1872). A biochemical survey of isozyme variation at 32 genetic loci allowed the estimation of the genetic differentiation between *S. dayi* and four other white-toothed shrews: *Suncus murinus* (Linnaeus, 1766), *Crocidura olivieri* (Lesson, 1827), *C. fuliginosa* (Blyth, 1855) and *C. russula* (Hermann, 1780). In its cranial and dental morphology, *Suncus dayi* retains many plesiomorphic features common to some members of the African genus *Sylvisorex*, whereas other species of *Suncus* instead show many apomorphic states. The electrophoretic survey indicates that *S. dayi* shares derived characters with *Crocidura* and *Suncus*, not with *Sylvisorex*. In combination, these studies do not exclude the conclusion that the peculiar morphology of *Suncus dayi* could be the result of convergent evolution related to its possibly scansorial way of life.

Key words. *Suncus*, Insectivora, India, systematics.

Introduction

Suncus dayi (Dobson, 1888) is a poorly known species from southern India recorded from the holotype deposited in the Natural History Museum, London and one other specimen presumed to be in the collection of the Zoological Survey, Bombay (see Lindsay 1929). Few authors elaborated on its original short description or commented on its status (Blanford 1888; Ellerman & Morrison-Scott 1966) and a century elapsed from the initial discovery, before seven additional specimens were collected from the Nilgiri Hills in southern India by the Catzeflis-Boursot Expedition to India in October 1990. These specimens have enabled us to study variation within the species and to perform more extensive comparisons with other taxa.

Although *S. dayi* has always been associated with species currently assigned to the genus *Suncus*, it exhibits a suite of characters differing from those found in most other members of this genus, which suggest that its affinities lie elsewhere. Comparisons have therefore been made with other similar and closely related genera belonging to the subfamily Crocidurinae or white-toothed shrews, namely *Suncus*,

Crocidura and *Sylvisorex*, and theories of possible relationships have been advanced, as reported below.

Besides the morphological examination, a comparative biochemical study of isozyme variation was undertaken in *Suncus dayi* and four other crocidurine shrews: *Suncus murinus*, *Crocidura russula*, *C. fuliginosa*, and *C. olivieri*. Electrophoresis of homologous proteins has proved an adequate and powerful approach for solving the systematics and evolutionary relationships of species and genera within the family Soricidae, as exemplified by recent studies of Catzeflis et al. (1985), George (1986) and Maddalena (1990b). The primary aim of the genetic survey was to decipher the probable relationships of *Suncus dayi* with regard to other white-toothed shrews, and to compare the new findings with those published for other Asian, African, and European members of the genus *Crocidura* sensu lato (Maddalena 1990b, Ruedi et al. 1990, 1993).

Material

Specimens used in the morphological analysis include the holotype of *Suncus dayi* BM (NH) 1867.11.14.7 adult of undetermined sex, skin and skull, Trichur, Cochin (10°31'N 77°13'E), and seven individuals from the Nilgiri Hills collected in October 1990 by P. Boursot, A. Orth and F. Catzeflis:

V-543 undetermined sex: Ootacamund: wet evergreen forest, 2150 m, 11°24'N 76°42'E;
V-557 juvenile male, V-562 subadult male, V-563 juvenile female,
V-567 juvenile female: Avallanchi: wet evergreen primary forest, 2100 m, 11°23'N 76°36'E;
V-572 subadult male, V-576 juvenile female: Kotagiri: wet evergreen primary and secondary forest, 1500 m, 11°26'N 76°53'E.

The following comparative material of other taxa in The Natural History Museum collections was examined:

13 specimens of *Suncus stoliczkanus* (Anderson, 1877) from Pakistan and India;
6 specimens of *Suncus etruscus* (Savi, 1822) from India;
3 specimens of *Suncus fellowesgordoni* Phillips, 1932 from Sri Lanka;
28 specimens of *Suncus murinus* (Linnaeus, 1766) from the Nilgiri Hills, India;
7 specimens of *Suncus lixus* (Thomas, 1898) from southern Africa;
7 specimens of *Sylvisorex johnstoni* (Dobson, 1888) from East and West Africa;
17 specimens of *Sylvisorex granti* Thomas, 1907 from East and West Africa;
11 specimens of *Sylvisorex megalura* (Jentink, 1888) from East and West Africa;
9 specimens of *Sylvisorex morio* (Gray, 1862) from Cameroon, West Africa;
20 specimens of *Crocidura attenuata* Milne-Edwards, 1872 from Assam, North East India;
20 specimens of *Crocidura fuliginosa dracula* Thomas, 1912 from North Vietnam.

The material used in the electrophoretic study included frozen tissue samples of seven *Suncus dayi* (V-543, V-557, V-562, V-563, V-567, V-572 and V-576) from Nilgiri Hills; eight *Suncus murinus* (V-546 to V-551, V-554 and V-555) from Mudumalai, Tamil Nadu, South India; three *Crocidura olivieri* (Lesson, 1827) from Central Africa (Maddalena 1990a, b); five *Crocidura russula* (Hermann, 1780) from Switzerland (Maddalena 1990a); and three *Crocidura fuliginosa* (Blyth, 1855) from Malaysia (Ruedi et al. 1990). Voucher specimens of all these animals are deposited in the collections of Lausanne (IZEA) and/or London (BM[NH]).

Methods

Morphological analysis

Measurements in millimetres were taken using dial calipers or a microscope measuring stage. The dental nomenclature follows that of Heim de Balsac & Lamotte (1957), Swindler (1976) and Butler & Greenwood (1979).

In their bench-mark work on African *Sylvisorex*, *Suncus* and *Crocidura*, Heim de Balsac & Lamotte (1957) determined which external and cranial characters were primitive for this

group and which were derived. Butler & Greenwood (1979) and Butler et al. (1989) similarly assessed the mandibular characters of fossil and Recent African Soricidae. One of us (PJ) has provided additional characters from the maxillary dentition and external features. Using the studies of these authors as a framework for the current analysis, primitive (plesiomorph) and derived (apomorph) characters have been scored for Asian and African members of the genera *Suncus* and *Sylvisorex*, with the objective of obtaining a relative ranking of *S. dayi*.

Electrophoretic study

Tissue samples (kidney, liver, heart) were frozen in liquid nitrogen immediately after autopsy in the field, and maintained at –70 °C at Lausanne until processing. Electrophoresis of homologous proteins was done as described in Ruedi et al. (1993) for studying the variation at the following 32 presumptive nuclear loci: (abbreviations as in Ruedi et al. 1993): Ada, Adh, Ak-1 & -2, Alb, Ck-1 & -2, Est-1, Got-1 & -2, Gpd, G-6-pd, Hk-1, Idh-1 & -2, Lap, Ldh-1 & -2, Mdh-1 & -2, ME, Mpi, Pa, Prot-x, 6-Pgd, Pgi, Pgm, Sod-1, -2 & -3, and Xdh-1 & -2. Alleles were designated by their mobility relative to the most common allele found in *C. olivieri* (Maddalena 1990b). Individual genotypes were transformed into allelic frequences by the BIOSYS-1 program (release 1.7; Swofford & Selander 1981) in order to compute Rogers (1972) and Nei (1978) genetic distances between pairs of compared taxa. The Rogers (1972) distances, which are additive, were treated by the Neighbor-Joining (Saitou & Nei 1987) and distance Wagner procedures (in BIOSYS-1) in order to yield dendrograms built without the hypothesis of rate-equality of biochemical changes among lineages.

Abbreviations used

BM(NH): The Natural History Museum, London, British Isles (formerly British Museum [Natural History]); IZEA: Institut de Zoologie et Ecologie Animale, University of Lausanne, Switzerland; ISEM: Institut des Sciences de l'Evolution de Montpellier, France.

c: circa; CBL: condylo-basal length; HB: head and body length; HF: hind foot length; m: metre; n: number; p: page; pers. comm.: personal communication; SD: standard deviation; TL: tail length.

Abbreviations for dental nomenclature are given in the text.

Results

Morphological analysis

Diagnosis and description: *Suncus dayi* is a dark brown, medium sized shrew (HB 70—78, CBL 18.9—20.2), with a long slender tail (TL 83—88), clothed in short hairs but lacking long bristle hairs. The hindfeet are elongated (15.5—16.5; ratio of HF to CBL 79.1—84.7), with elongated cheiridia.

The cranium has a relatively short rostrum, with a broad interorbital region and the braincase is rounded and domed (see Figs 1—2 and Table 1). The fourth upper unicuspid (Un^4) is slightly smaller than the second (Un^2); the cingula on the upper unicuspids are broad and distally flared. The third upper molar (M^3) is long relative to the upper toothrow. The first lower incisor (I_1) has two marked denticulations. The last lower molar (M_3) has a distinct talonid basin and entoconid with a very short entoconid ridge.

Comparison with other taxa: *Crocidura* is characterised by the possession of three upper unicuspid teeth, so clearly *S. dayi* does not conform in this diagnostic character; *S. dayi* also lacks the bristle hairs on the tail characteristic of *Suncus* and of most species of *Crocidura*. *Crocidura* apparently has a restricted distribution in India; only the very small *Crocidura horsfieldii* (Tomes, 1856) has been recorded from southern India (HB < 75, CBL < 18.0). Brief comparisons were therefore made

Table 1: Characters of *Suncus dayi* and *Suncus fellowesgordoni* relative to *Sylvisorex* and *Suncus*. P: plesiomorphic character state; I: character of intermediate expression; A: apomorphic character state.

Character	Plesiomorphic state	*Sylvisorex*	*Suncus dayi*	*Suncus fellowesgordoni*	*Suncus*	Apomorphic state
Tail: vibrissae	absent	P	P	A	A	present
hairs	very short	P	I	A	A	long
thickening	absent	P	P	P	A	present
Hindfeet:	longer & broader	P	P	A	A	shorter, narrower
cheiridia	widely spaced	P	P	A	A	adpressed
Braincase	convex or elevated	P	P	A	A	flattened
ratio of braincase height to upper toothrow length		>58 %	58–60 %	51.7 %	<54 % [*S. lixus* 51–56 %]	
Interorbital region	broad	P/I	P	P	A [*S. etruscus* P]	narrow
ratio of interorbital breadth to maxillary breadth		>75 % [*S. johnstoni* 71 %]	76–88 %	77.5 %	<71 % [*S. etruscus* 76–84 %]	
I1: anterior cusp	short, stout, proodont	P	P	A	A	tall, slender, opisthodont
talon	well developed	P	P	P	A	reduced
Fourth unicuspid	present	P	P	P	P	absent
	less reduced in size	P	P	P	A	more reduced
buccal and lingual cingula	broad, well developed	P	P	P	A [*S. etruscus* I, *S. lixus* P]	narrow
P^4: talon	long, well developed	P	P	P	A	short, reduced
protocone	well developed	P [*S. johnstoni* A]	P	P	P [*S. etruscus* A]	reduced
hypocone	well developed	P [*S. johnstoni* A]	I	A	A	reduced
parastyle	well developed	P [*S. johnstoni* A]	I	P	A [*S. murinus* I, *S. etruscus* P]	reduced
M^3:	long, well developed	P	P	I	A [*S. murinus* I]	short, reduced
Ratio of M^3 length to upper toothrow length		>7.5 %	7.8–8.5 %	7.6, 7.8 %	<7.4 % [*S. murinus* 6.6–8.1 %]	

Table 1: continued

Character	Plesiomorphic state	*Sylvisorex*	*Suncus dayi*	*Suncus fellowesgordoni*	*Suncus*	Apomorphic state
Mandible: ratio of condyle width to height	less than 80 %	A >80 %	P 57–65 %	P 76.3 %	A >82 %	greater
ratio of horizontal ramus depth to M_1–M_3 length	less than 36 %	P <36 %	P 29–33 %	P 30.3 %	A >36 %	greater [*S. etruscus* 29–35 %]
I_1: elevations on posterior ridge	two	P	P	P	A	none
anterolingual ridge	low, parallel to ventral border, long	P	P	P	A [*S. lixus* P]	higher, divergent short
posterolingual cingulum	present	P	A	[P]	A	absent
ratio of I_1 length to M_1–M_3 length	75 % or less	I <86 %	I 76–81 %	I 72, 78 %	A >82 %	greater, up to 100 % or more
ratio of I_1 height to M_1–M_3 length	20 % or less	P, I <24 % [*S. granti* 17–20 %]	P 18–20 %	I 18, 21 %	I, A >20 % [*S. lixus* 17–23 %]	greater, up to 28–29 % or more
I_2: protostylid	present	P, A	A	A	A	absent
P_4: protostylid	present	P, A	A	A	A	absent
overlap of I_2 c 0.25 length of I_2		P, A	P	P	A [*S. lixus* P]	greater
M_1: ratio of breadth to length	67 % or less	I	A	A	A	greater, up to 80 %
M_1, M_2: post-entoconid ledge	wide	P, I	I	I	A	narrow
lingual cingulum	complete	P, A	P	P	P, A	confined to anterior or absent
M_3: talonid	well-developed, resembling M_2	P, I, A	P	I	I, A	simplified

between *S. dayi* and the slightly larger *Crocidura attenuata* found in Assam, north east India and in Southeast Asia (Assam specimens HB 70–87, CBL 19.7–21.6), and also with *Crocidura fuliginosa* from Southeast Asia, which is considerably larger (Vietnam specimens HB > 85, CBL >22.2). The latter was the only Asian species available for the electrophoretic analysis, therefore it was also included in the morphological study, but because it is readily distinguished from *Suncus dayi* by its much greater size, comparisons given below were restricted to the more comparably sized *C. attenuata.*

Crocidura attenuata differs externally from *Suncus dayi* in its grey brown pelage colour and shorter, bristle haired tail (ratio of TL to HB 70–95). The skull has a longer, shallower rostrum and the braincase is shallower, less rounded with slightly more angular superior articular facets. The mandible has a deeper, straighter horizontal ramus, while the ramal fossa is smaller and broader. The most obvious dental differences are the absence of the fourth upper unicuspid, and the shape of the first upper incisor, with its elongated anterior cusp (see Fig. 2).

Suncus dayi is compared here with other species of *Suncus* which occur in India: *S. murinus*, *S. stoliczkanus* and *S. etruscus*. *Suncus dayi* is considerably larger than *S. etruscus* (HB < 55, CBL < 14.0), and considerably smaller than *S. murinus* (HB > 100, CBL > 23.5). Confusion with *S. murinus* and *S. etruscus* is therefore unlikely and no further reference is made to these two species.

Suncus dayi (HB 70–78, CBL 18.9–20.2) is similar in size to *S. stoliczkanus* (HB 68–85, CBL 18.6–22.2); however the external appearance of *S. dayi* and *S. stoliczkanus* is otherwise quite different: *S. dayi* is dark brown dorsally and ventrally, the tail is uniformly dark brown, longer than head and body (TL 83–88; ratio of TL to HB 109.9–123.5), clothed with short hairs but lacking the long bristle hairs which are characteristic of *Suncus* and most species of *Crocidura;* the hindfeet are elongated (15.5–16.5, ratio of HF to CBL 79.1–84.7), the cheiridia are widely spaced and elongated. In contrast, *Suncus stoliczkanus* ranges in colour from pale grey to grey brown dorsally, paler ventrally; the tail is pale grey to grey brown, shorter than head and body (TL 44–55; ratio of TL to HB 60.8–76.8), with long bristle hairs; the hind feet are medium sized (10.5–15.0; ratio of HF to CBL 56.5–75.2), and the cheridia are adpressed and rounded.

Suncus dayi is similar in many features to members of the African genus *Sylvisorex*, and it is compared here with the slightly smaller *Sylvisorex morio,* with additional comments on other species of *Sylvisorex* where *S. morio* is atypical. In the following external features, *S. dayi* shows a closer resemblance to members of the genus *Sylvisorex* than to those of *Suncus.* The tail is long, slender and, as in *Sylvisorex*, lacks the long bristle hairs which are characteristic of *Suncus* and most species of *Crocidura;* instead the tail has short hairs, which are longer and more numerous than those of *S. morio* (some Indomalayan species of *Crocidura-C. elongata* Miller & Hollister, 1921; *C. miya* Phillips, 1929 and *C. paradoxura* Dobson, 1887 — also have a long slender tail with few or no long bristle hairs). The cheiridia on the hindfeet of *S. dayi* and *S. morio* are elongated, unlike the rounded cheiridia of *S. stoliczkanus.*

In craniodental morphology and proportions, *S. dayi* is also more similar to *Sylvisorex* than to *Suncus* (see Figs 1–6, and Tables 1–2). The skull of *S. dayi* is more similar to that of *S. morio* in general shape; the rostrum of both species is

Fig. 1: Dorsal view of cranium from left to right of *Sylvisorex morio* (BM [NH] 88.81), *Suncus dayi* (V-576), *Suncus fellowesgordoni* (BM [NH] 32.6.11.1), *Suncus stoliczkanus* (BM [NH] 79.586) and *Crocidura attenuata* (BM [NH] 27.3.7.2).

Fig. 2: Lateral view of cranium from left to right of above *Sylvisorex morio* (BM [NH] 88.81) and *Suncus dayi* (V-576), below *Suncus fellowesgordoni* (BM [NH] 32.6.11.1), *Suncus stoliczkanus* (BM [NH] 79.586) and *Crocidura attenuata* (BM [NH] 27.3.7.2).

relatively short, while that of *S. stoliczkanus* is slightly elongated and parallel-sided; the angle between the rostral portion of the maxilla carrying the unicuspid teeth and the premolar and molar portion of the maxilla is much more acute in *S. stoliczkanus*

Table 2: Selected measurements in specimens of *Suncus stoliczkanus*, *Suncus dayi*, *Sylvisorex morio* and *Crocidura attenuata*. Range, mean ± standard deviation, sample size.

	Suncus stoliczkanus	*Suncus dayi*	*Sylvisorex morio*	*Crocidura attenuata*
Condylobasal length	18.6−22.2 19.78±1.03 11	18.9−20.2 19.66±0.40 7	17.1−18.8 17.91±0.50 9	19.7−21.6 20.20±0.52 10
Upper toothrow length	8.1−10.3 9.07±0.65 11	8.5−8.8 8.66±0.13 7	7.8−8.4 8.07±0.21 9	8.0−9.8 8.90±0.47 21
Maxillary breadth at level of M^2	5.2−6.9 5.98±0.40 11	5.6−6.0 5.83±0.16 7	5.1−5.4 5.29±0.10 9	5.5−6.5 6.00±0.23 21
Interorbital breadth	3.8−4.3 3.98±0.14 10	4.3−4.7 4.47±0.13 7	4.1−4.6 4.31±0.13 9	4.1−4.7 4.37±0.15 14
Braincase breadth	8.3−9.8 8.73±0.41 10	8.9−9.6 9.34±0.22 7	8.6−9.4 8.97±0.23 9	8.7−9.8 9.08±0.32 11
Braincase height	3.9−5.0 4.30±0.32 10	5.0−5.3 5.12±0.12 6	4.8−5.2 5.01±0.15 8	4.4−5.3 4.89±0.25 10
Braincase length	7.9−9.0 8.36±0.30 10	7.8−8.5 8.09±0.21 7	6.9−7.4 7.20±0.17 8	8.0−8.9 8.26±0.25 10
Interorbital breadth: maxillary breadth	59.4−71.4 66.33±0.28 10	72.9−88.0 78.10±4.40 7	75.9−86.8 81.40±3.12 9	68.9−77.6 72.69±2.24 14
Length of M^3: upper toothrow length	6.0−7.0 6.48±0.28 10	7.6−8.5 8.07±0.35 7	8.2−9.6 8.96±0.41 9	7.1−8.0 7.56±0.25 18
Braincase breadth: condylobasal length	42.0−45.3 43.90±1.12 10	46.1−48.0 47.51±0.37 7	47.0−52.6 50.08±1.53 9	42.0−47.6 44.81±1.42 10
Braincase height: condylobasal length	19.8−23.2 21.65±1.00 10	25.1−27.0 25.82±0.58 6	26.9−28.9 28.06±0.59 8	21.9−25.5 24.22±1.04 9
Braincase length: braincase breadth	91.8−100.0 95.72±2.33 10	83.9−89.9 86.57±2.40 7	76.7−83.1 80.12±2.07 8	87.9−96.6 90.95±3.00 10

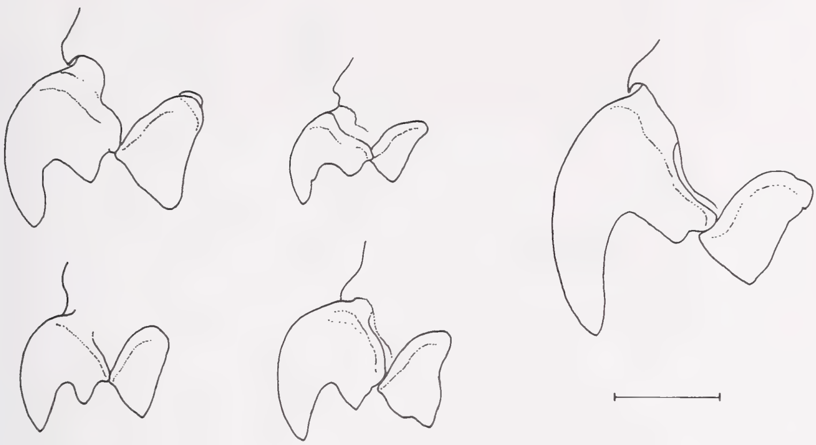

Fig. 3: Buccal view of left upper Incisor and Un[1] from left to right of above *Suncus dayi* (V-576) and *Suncus fellowesgordoni* (BM [NH] 32.6.11.1), middle *Sylvisorex granti* (BM [NH] 11.4.7.12) and *Sylvisorex morio* (BM [NH] 88.86), right *Suncus stoliczkanus* (BM [NH] 79.586). Scale 1 mm.

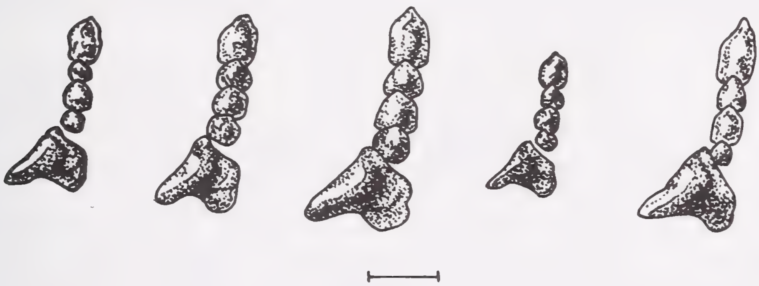

Fig. 4: Occlusal view of right Un[1]—Un[4] and P[4] from left to right of *Sylvisorex granti* (BM [NH] 11.4.7.12), *Sylvisorex morio* (BM [NH] 88.86), *Suncus dayi* (V-576), *Suncus fellowesgordoni* (BM [NH] 32.6.11.1) and *Suncus stoliczkanus* (BM [NH] 30.2.11.138). Scale 1 mm.

than in *S. dayi* or *S. morio.* The interorbital region of *S. stoliczkanus* is relatively narrower and increases only slightly from anterior to posterior, whereas the posterior portion of the interorbital region is much broader than the anterior in *S. dayi* and *S. morio.* Both *S. dayi* and *S. morio* have rounded, domed braincases, while that of *S. stoliczkanus* is shallow, flat and laterally angular. The braincase is short relative to condylobasal length in *S. morio*, moderate in *S. dayi* but long in *S. stoliczkanus.* The parieto-occipital suture is prominently ridged in *S. stoliczkanus*, scarcely evident in *S. dayi* and practically absent in *S. morio.* The shape of the first upper incisor (I^1) is more similar in *S. dayi* and *S. morio* than in *S. stoliczkanus.* In *S. dayi* and

S. morio this tooth is more proodont, the anterior cusp is moderately stout, and less than twice the height of the posterior cusp, while in *S. stoliczkanus* I^1 is opisthodont, the anterior cusp is slender and elongated and more than twice the height of the posterior cusp. The cingula on the upper unicuspid teeth of *S. dayi* are broad and distally flared as in *S. morio* but unlike those of *S. stoliczkanus*, which further differs in the position of the fourth upper unicuspid (Un^4), which is partially obscured by the protocone of the premolar (P^3) in distal view. In *S. dayi* the lingual cingula of Un^1 , Un^3 and Un^4 and the buccal cingulum of Un^2 are broader than those of *S. morio.* In *S. dayi* and *S. morio*, P^3 has a prominent hypocone and well-developed talon, unlike *S. stoliczkanus* in which the hypocone is low and the talon reduced in size. The third upper molar (M^3) of *S. dayi* and *S. morio* is longer relative to the upper toothrow than that of *S. stoliczkanus.* The first lower incisor (I_1) of *S. dayi* has two marked denticulations and the anterolingual ridge is complete and parallel with the ventral border as in *S. morio* but unlike *S. stoliczkanus* which shows no denticulation and the anterolingual ridge is incomplete and divergent. A protostylid is present on the lower premolar (P_4) of *S. morio* and *S. granti*, but absent in most other species of *Sylvisorex* as well as in *S. dayi* and *S. stoliczkanus.* The talonid of the last lower molar (M_3) differs in all three species; in *S. morio* the talonid basin, entoconid and entoconid ridge are well developed; in *S. dayi*, the talonid basin and entoconid are distinct but the entoconid ridge is very short, while in *S. stoliczkanus* the talonid basin is distinct, the entoconid ridge low but the entoconid less distinct. The development of the talonid of M_3 is variable within *Sylvisorex* but is usually reduced in *Suncus.*

Historical perspective and morphological relationships: In his original description, Dobson (1888) placed the new species in *Pachyura* Sélys-Longchamps, 1839, which at that time was considered to be a subgenus of *Crocidura* but was later recognised as a distinct genus under the senior synonym of *Suncus.* An illustration of the lateral view of the anterior maxillary toothrow was given by Dobson (1890, Plate 28, Fig. 6). The few subsequent authors (Blanford 1888; Lindsay 1929; Ellerman & Morrison-Scott 1966) who examined this litte known and poorly represented species, only commented on the unusually large fourth upper unicuspid. Ellerman & Morrison-Scott considered that it was probably a member of the *Suncus stoliczkanus* group.

In the course of collaborative work with R. Hutterer, Bonn (pers. comm. 1988), several of the taxa of Asian *Suncus* were examined, including the holotype of *S. dayi* and three specimens of *S. fellowesgordoni*, another poorly known taxon generally regarded as a subspecies of the widespread species *Suncus etruscus* (see Ellerman & Morrison-Scott 1966; Eisenberg & McKay 1970; Corbet & Hill 1992). These two taxa (*S. dayi*, *S. fellowesgordoni*) showed some similarities in several characters not generally found in other species of *Suncus* (see Table 1). Many of these characters are regarded as primitive, following the views of Heim de Balsac & Lamotte (1957), Butler & Greenwood (1979), and Butler et al. (1989). Butler (1978: p. 62) stated that some species of *Suncus* in Asia, such as *S. fellowesgordoni* from Sri Lanka, have primitive characters like *Sylvisorex*, such as a narrow mandibular condyle and a basined talonid on M_3, and they cast doubt on whether the two genera should be

Fig. 5: Lingual view of right 1_1 and I_2 from left to right of above *Sylvisorex granti* (BM [NH] 71.1828) and *Sylvisorex morio* (BM [NH] 88.86), middle *Suncus dayi* (V-576) and *Suncus fellowesgordoni* (BM [NH] 32.6.11.1), below *Suncus stoliczkanus* (BM [NH] 79.586). Scale 1 mm.

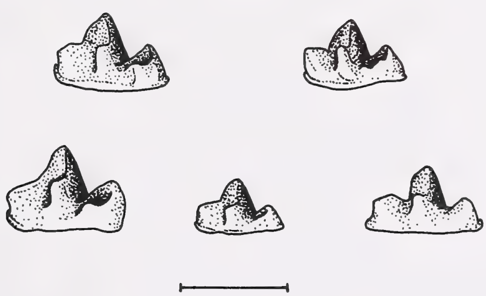

Fig. 6: Lingual view of right M_3 from left to right of above *Sylvisorex morio* (BM [NH] 88.86) and *Syvisorex granti* (BM [NH] 11.4.7.12), below *Suncus dayi* (V-576), *Suncus fellowesgordoni* (BM [NH] 32.6.11.1) and *Suncus stoliczkanus* (BM [NH] 79.586). Scale 1 mm.

separated. Butler et al. (1989: p. 402) repeated this view that *Suncus* includes some primitive forms such as *S. fellowesgordoni*; they noted that most species of *Suncus* are from the Indomalayan Region and suggested that this genus may have arisen from a *Sylvisorex*-like form in Asia, which subsequently extended its range into Africa.

Table 1 shows that *Sylvisorex* is plesiomorphic in the majority of its character states, while the majority of the characters of *Suncus* are apomorphic. Although not shown here, *Crocidura attenuata* and *C. fuliginosa* also show more apomorphic than plesiomorphic characters; it is hoped to discuss the relationships of these species of *Crocidura* and *Suncus* in a separate paper.

Examination of *S. fellowesgordoni* confirms the above observations that many of its characters are plesiomorphic (see Table 1) and common to *S. dayi* and *Sylvisorex*, but also shows 10 shared derived features (synapomorphies) with *Suncus* and 3 with the *Sylvisorex granti* group. Comparison of *S. dayi* reveals an even larger suite of plesiomorphic characters in common with *Sylvisorex*, and a few synapomorphic features with *Suncus* (4), *S. fellowesgordoni* (3) and 2 with the *Sylvisorex granti* group.

Electrophoretic study

Among the 32 assayed presumptive loci, 19 did evidence some intra- and/or inter-specific polymorphism, whereas 13 showed no electrophoretic variation (Ak-1, Ck-1 & -2, Got-2, Gpd, Hk-1, Ldh-1, Mdh-1 & -2, Prot-x, Sod-3, and Xdh-1 & -2). Table 3 indicates the observed allelic frequences at all polymorphic loci. An intra-specific polymorphism for *Suncus dayi* does exist at the two most variable loci (Ada and Est-1), but only two heterozygotes were observed, namely alleles 65 and 87 at locus Ada for specimens V-543 and V-563.

The genetic distances (based on all 32 loci) were computed by using the indices of Rogers (1972) and of Nei (1978) (Table 4), which indicate a clearcut biochemical (genetical) differentiation between all samples (minimum value of ca. 0.28 for Nei's distance and 0.26 for Rogers' distance). Interestingly, *Suncus murinus* is roughly equally divergent from *S. dayi* as from *C. fuliginosa*, and these are the smallest distances in the matrix of Table 4. According to both kinds of genetic distances, *S. dayi* is however slightly more related to *Suncus murinus* than to any other crocidurine shrew so far tested. These relationships are tentatively represented on the dendrograms derived from two clustering methods which do not depend upon the hypothesis of rate-uniformity (Neighbor-Joining and Wagner) neither of which take into account the standard-deviation of branch lengths estimates. Both tree-reconstruction methods indicate strong differences in rates of biochemical change, with for example *C. russula* having accumulated more changes than the other taxa. Moreover, as illustrated by Figure 7, the two branching patterns conflict with regard to the position of the two species of *Suncus* relative to the Eurasian *Crocidura*. This is not astonishing, as a casual inspection of the half matrices of Table 4 indicates that there is no strong genetic discontinuity between these crocidurine shrews, as all taxa appear to split off at about the same genetic level of differentiation (at a genetic distance of ca. 0.3). Thus, the branching patterns derived from both clustering procedures suggest the paraphyly of the genus *Suncus* and/or of the genus *Crocidura*.

Ecology

Suncus dayi has recently been collected from tropical evergreen forest (with *Rattus satarae* Hinton, 1918, *Rattus rattus* [Linnaeus, 1758], *Mus famulus* Bonhote, 1898 and *Suncus murinus*) in the Nilgiri Hills at 1500–2150 m and is also recorded in the

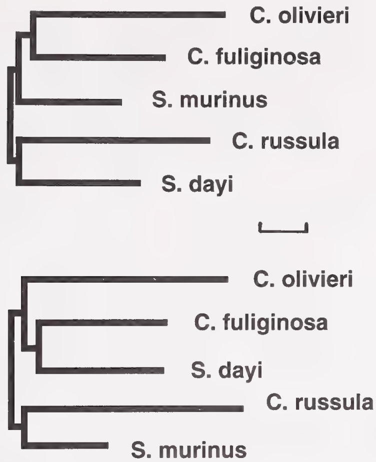

Fig. 7: Phenograms derived from the Neighbor-Joining (above) and Wagner (below) procedures on Rogers (1972) genetic distances. Both networks were arbitrarily rooted at midpoint of longest path. The branch lengths are a good approximation of the observed distances (of Table 4), as indicated by the values of the percent standard deviation (2.87 % and 6.16 %) and of the cophenetic correlation (0.984 and 0.968) for the Neighbor-Joining and Wagner trees, respectively. The bar (scale) is 0.05 units of genetic distance.

literature from the Palni Hills (Lindsay 1927). There is doubt about the collection locality of the holotype, as Dobson (1888) stated that the exact locality was unknown but gave the habitat as the Madras Presidency, India. Blanford (1888: 240) surmised that this specimen was probably obtained from the Palni or Travancore Hills in the Madras Presidency; subsequently Blanford (1891: 602) explained that the specimen had been brought to the donor, Dr. F. Day, from Trichur, Cochin. All of these localities are in southern India; the vegetation consists of tropical, high altitude evergreen rain forests. Both Nilgiri and Palni are hill forests, isolated from each other by the surrounding lower lying country which consists of a mixture of secondary forests (most of which are cultivated by man) and cleared, cultivated land (mainly tea and potatoes) and scrub.

Heim de Balsac & Lamotte (1957) stated that *Sylvisorex* and *Suncus* ecologically differ in Africa, *Suncus* occurring in semi-arid savanna, while *Sylvisorex* inhabits wetter forests (although one species, *S. megalura* — which has clear scansorial adaptations [Vogel 1974, Hutterer 1985] —, has been recorded in grassland).

The combination of features such as a long tail, elongated feet with elongated, well-spaced cheiridia, were interpreted as adaptations to a scansorial way of life (Hutterer 1985) and are characteristic of *Sylvisorex megalura*, *Suncus mertensi* Kock, 1974 and of some Indomalayan *Crocidura* such as *C. miya*, *C. paradoxura* and *C. elongata*. The implication is that *S. dayi* is also scansorial and therefore probably occupies a different ecological niche to the sympatric pigmy, *S. etruscus*, and the

Table 3: Allelic frequences observed at 19 polymorphic loci among five studied species. N: sample size..

Locus/Allele		*Suncus dayi* N=7	*Suncus murinus* N=8	*Crocidura olivieri* N=3	*Crocidura fuliginosa* N=3	*Crocidura russula* N=5
Ada:	211		.375			
	173		.625			
	138				.167	
	119				.833	
	100			.833		.375
	83	.714				.625
	75			.167		
	64	.286				
Adh:	.100		1.000	1.000	1.000	1.000
	73	1.000				
Ak-2:	125					1.000
	100		1.000	1.000	1.000	
	70	1.000				
Alb:	103	.071				
	100		1.000	1.000		
	96	.929				
	94				1.000	
	91					1.000
Est-1:	135	.857	1.000			1.000
	112	.143				
	100			1.000		
	82				1.000	
Got-1:	200				1.000	
	100	1.000	1.000	1.000		1.000
G-6-pd:	123				1.000	
	112	1.000	1.000	.500		1.000
	100			.500		
Idh-1:	150	1.000	1.000		1.000	1.000
	100			1.000		
Idh-2:	120		1.000			
	100	1.000		1.000	1.000	
	75					1.000
Lap:	100			1.000		
	96	1.000	1.000		1.000	1.000
Ldh-2:	110	1.000	1.000		1.000	1.000
	100			1.000		
Mod:	100			1.000		
	85	1.000				
	74		.313		1.000	
	70					1.000
	26		.687			

Table 3: continued

Locus/Allele		*Suncus dayi* N=7	*Suncus murinus* N=8	*Crocidura olivieri* N=3	*Crocidura fuliginosa* N=3	*Crocidura russula* N=5
Mpi:	132		1.000			
	100	1.000		.500	1.000	.500
	70			.500		.500
Pa:	100			1.000		
	80	1.000	1.000		1.000	1.000
6-Pgd:	140					1.000
	100	1.000	1.000	1.000	1.000	
Pgi:	200					1.000
	100	1.000	1.000	1.000	1.000	
Pgm:	150		.063		.278	
	117		.938		.722	
	100			1.000		1.000
	78	1.000				
Sod-1:	115		.625			
	100	1.000	.375	1.000	1.000	
	84					1.000
Sod-2:	100	1.000	1.000	1.000	1.000	
	30					1.000

giant, *S. murinus*, species. Regrettably there are no detailed observations to support these hypotheses.

Discussion

Species currently assigned to the genus *Sylvisorex* are confined to Africa. There is some controversy over the number of species recognised as belonging to the genus *Suncus*, which is found in Asia, Africa and Europe. Following Hutterer (1993) only four species are endemic to Africa, whereas nine occur in Asia and a tenth — *S. murinus* — is Asian in origin and believed to be a recent introduction to Africa (Heim de Balsac & Lamotte 1957, Hutterer & Tranier 1990). The area of greatest species diversity is generally accepted as the most probable site of origin of the group which, in the case of *Suncus*, is likely to be Asia.

Morphological results

Heim de Balsac & Lamotte (1957) suggested that *Sylvisorex* is ancestral to *Suncus*, the former possessing a greater number of primitive, and the latter a greater number of derived characters. These authors briefly alluded to the resemblance noted by Ellerman et al. (1953) between the African *S. lixus* and the Asian *S. stoliczkanus*. It was Butler (1978), Butler & Greenwood (1979) and Butler et al. (1989) who produced

Table 4: Genetic distances measured between five species of Crocidurinae. Below diagonal: Rogers (1972) genetic distance; above diagonal: Nei (1978) unbiased genetic distance. *S.*: *Suncus*; *C.*: *Crocidura*.

	Suncus dayi	*Suncus murinus*	*Crocidura olivieri*	*Crocidura fuliginosa*	*Crocidura russula*
S. dayi	000	.281	.432	.303	.400
S. murinus	.261	000	.377	.277	.378
C. olivieri	.366	.332	000	.407	.572
C. fuliginosa	.269	.262	.347	000	.517
C. russula	.342	.323	.439	.412	000

evidence of the possible derivation of African species of *Suncus* from *Sylvisorex* and furthermore, suggested that if this did not occur in Africa it might have done so from a *Sylvisorex*-like ancestral form in Asia which subsequently extended its range into Africa. They suggested that the fossil species of *Suncus* may have entered Africa rather late and that the main source of the immigrants was the Indomalayan region. They also demonstrated that *Suncus lixus* is dissimilar to the other African species of *Suncus*; it shares derived characters with two species of *Sylvisorex*, the fossil *S. olduvaiensis* Butler & Greenwood, 1979 and the Recent *S. johnstoni* (Dobson, 1888b) and could have been derived from a related species of *Sylvisorex* and, if it did not originate from *Sylvisorex* in Africa, it must be presumed to be an immigrant from Asia. Butler et al. (1989) cited the primitive characters, reminiscent of *Sylvisorex* found in some species of Asian *Suncus*, such as *S. fellowesgordoni*. It is therefore interesting to note that their view is further supported by another Asian species, *S. dayi* which shows an even higher proportion of primitive characters, so much so that it groups more readily with species of *Sylvisorex* than with those of *Suncus*. Butler et al. (1989) observed that *Sylvisorex* is definable only by primitive characters. These authors noted that *Suncus* was much more advanced than *Sylvisorex* and could feasibly be related to the *Sylvisorex granti* group (defined by these authors to include the species *granti*, *megalura*, *howelli* Jenkins, 1984, *johnstoni* and *olduvaiensis*). Table 1 shows that *S. dayi* has many primitive (plesiomorphic) features in common with *Sylvisorex*, but fewer with *Suncus*, which exhibits many more derived (apomorphic) character states. The results show that *Suncus dayi* is synapomorphic in only four characters, whereas *S. fellowesgordoni* is synapomorphic with *Suncus* in ten characters. This suggests that *S. fellowesgordoni* has a closer relationship with other species of the genus *Suncus* than does *S. dayi*. *Suncus dayi*, however, retains many plesiomorphic features common to *Sylvisorex*, shows few synapomorphies with either *Sylvisorex* or *Suncus*, and exhibits such a close resemblance to *Sylvisorex* that it could feasibly be reassigned to this genus. However, as shown in the next section discussing electrophoretic data, the lack of shared derived alleles between *S. dayi* (this paper) and *Sylvisorex* (Maddalena et al. 1990a, b) is a strong argument for preferring the conservative decision to continue to assign *S. dayi* to the genus *Suncus*.

Based on the interpretation of characters listed in Table 1, the problem remains as to whether *S. dayi* is a relict species, differing only in a few apomorphic features from the *Sylvisorex*-like ancestral form of *Suncus*, as postulated by Butler et al. (1989); or one of convergent evolution due to adaptation to a similar ecological niche, as suggested by Hutterer (1985) who pointed out that convergent evolution may have occurred several times in scansorial shrews.

Additional experiments with genetic markers (DNA sequencing, protein electrophoresis) are needed to understand the relationships of Asian and African white-toothed shrews of the genera *Suncus*, *Sylvisorex* and *Crocidura*. Furthermore, our comparative morphological analysis should be extended to include Indomalayan scansorial species of *Crocidura* such as *C. miya* from Sri Lanka, *C. paradoxura* from Sumatra and *C. elongata* from Sulawesi in order to test for morphological convergence.

Electrophoretic results

The endemic South Indian *Suncus dayi* appears to be genetically well differentiated from the sympatric species *Suncus murinus* (Fig. 7). However, *S. murinus* is almost as divergent from *S. dayi* as from the Indomalayan *C. fuliginosa* (Nei's distances of ca. 0.28: Table 4). This observation, as well as the conflicting topologies derived from the two phenetic reconstructions, suggest that all taxa analysed here might have diverged from each other at about the same time. Table 4 also reveals that the genetic distances measured in inter-generic comparisons are quite low by crocidurine standards: for example, Maddalena (1990b) has measured an average Nei's distance of 0.72 (SD 0.12, range 0.50−0.92) between *Suncus etruscus* and 20 species of African and European *Crocidura*. When Indomalayan representatives of *Suncus* and *Crocidura* are compared (Figure 11), the apparent paraphyletic placement of *Crocidura* is reminiscent of the finding of Maddalena (1990b), and this is in agreement with some traditional morphological studies (Heim de Balsac & Lamotte 1957, Butler et al. 1989). As *Sylvisorex* could not be included in this electrophoretic study, its genetic relationship with *S. dayi* cannot be directly assessed. Nevertheless, as Maddalena (1990a, b) used the same standard (*Crocidura olivieri*) for naming the different alleles, some comparison is possible for a subset of loci. In the cladogram proposed by Maddalena (1990b: 301), *Sylvisorex megalura* and *S. lunaris* (which were considered as an outgroup relative to *Crocidura*) shared two synapomorphic alleles: Ldh-2^{170} and Mdh-2^{84}. Neither of these alleles has been found among our Asian samples, thus suggesting no direct link between *S. dayi* and these two species of *Sylvisorex*. On the contrary, allele Idh-1^{150} in Maddalena (1990a, b) is shared by most other crocidurine shrews, and it is also observed in *S. murinus*, *S. dayi* and *C. fuliginosa*. Several synapomorphies (AK-1^{100}, Est-1^{110}, Ldh-2^{100}, Mdh-2^{100}, and Pgi^{100}) link our Asian samples with most species of *Crocidura* analysed by Maddalena (1990a, b), and not with *Sylvisorex*. These few genetic comparisons all indicate that *Suncus dayi* (and, by extension, the other Asian taxa analysed here) is not closely related to the African *Sylvisorex*, but instead shares several derived genetic characters with other shrews of the genera *Crocidura* and *Suncus*. The genetic affinities of *Suncus dayi* within a cluster containing *Suncus murinus* as well as some species of *Crocidura* indicate polyphyly for one or both genera. In conclusion, the genetic

results, although still preliminary, do not support a close relationship between *S. dayi* and *Sylvisorex*, but rather suggest parallelism for the cranial similarities and convergence for the external scansorial adaptation.

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Zusammenfassung

Biochemische und morphologische Untersuchungen von *Suncus dayi* (Dobson, 1888) und die Diskussion der Verwandtschaft von *Suncus*, *Crocidura* und *Sylvisorex* (Insectivora: Soricidae). — Während einer Feldexpedition in den immergrünen Bergregenwald von Südindien konnten im Nilgiri Gebirge 7 Exemplare von *Suncus dayi* (Dobson, 1888), einer wenig bekannten Weißzahn-Spitzmaus, erbeutet werden. Die äußere Morphologie sowie Schädel- und Zahnmerkmale dieser Spezies wurden in einer vergleichenden Studie mit wenigen Arten der Gattungen *Suncus* (z. B. *S. stoliczkanus*, *S. fellowesgordoni*), *Sylvisorex* (z. B. *S. morio*, *S. granti* Gruppe) und *Crocidura* (z. B. *C. attenuata*) betrachtet. Eine biochemische Untersuchung der Isoenzymvariation an 32 Genloci erlaubt die Abschätzung der genetischen Differenzierung zwischen *S. dayi* und vier weiteren Weißzahn-Spitzmäusen: *Suncus murinus*, *Crocidura olivieri*, *C. fuliginosa* und *C. russula*. In der Schädel- und Zahnmorphologie teilt *Suncus dayi* viele plesiomorphe Merkmale mit einigen Vertretern der afrikanischen Gattung *Sylvisorex*, wohingegen andere Arten der Gattung *Suncus* in diesen Merkmalen apomorphe Muster aufweisen. Eine elektrophoretische Untersuchung zeigt Übereinstimmung in abgeleiteten Merkmalen zwischen *Crocidura* und *Suncus*, aber nicht zwischen *Sylvisorex* und *Suncus*. Insgesamt kann diese Studie nicht ausschließen, daß die eigentümliche Merkmalsverteilung bei *Suncus dayi* ein Ergebnis konvergenter Entwicklung in Verbindung mit kletternder Lebensweise ist.

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Biogeographical and karyological data of the *Microtus savii* group (Rodentia, Arvicolidae) in Italy

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Abstract. Two species in an early stage of speciation were found in Italy within the *Microtus savii* complex: *M. savii* in the described area of the species and *M. brachycercus* in Calabria. Karyological analyses of specimens from a wider geographic area confirmed the occurrence of the G-banded karyotype of *M. savii* in north-central Italy and Sicily. The G-banded karyotype of *M. brachycercus* was found in Calabria and a third chromosome form with an acrocentric X in the south-east of Italy. The C-banded karyotype confirms the homogeneity of autosomal C-bands, apart from a small variant in the third chromosomes pair, and C-band variations in the sex chromosomes.

Key words. Rodents, *Microtus savii* complex, chromosome banding, polymorphism.

Introduction

On the basis of slight differences in morphological traits three different subspecies of the Savi pine vole *Microtus savii* (De Sel.) were described in Italy. Comparisons among banded karyotypes of specimens from Rosarno (Calabria), where the subspecies *M. savii brachycercus* (von Lehmann, 1961) occurs, and from central Italy (Pisa and Viterbo), where the subspecies *M. savii savii* (De Sélys Longchamps, 1838) is present, revealed identical autosomal complements but marked differences in sex chromosomes (Galleni et al. 1992). Since male hybrid specimens from crosses between the two different karyomorphs were sterile, *M. savii brachycercus* and *M. savii savii* were considered different species in an early stage of speciation (Galleni et al. 1994). Krapp & Winking (1976) found a karyotype similar to that of *M. savii savii* in a third subspecies, *M. savii nebrodensis* (Mina-Palumbo, 1868), from Sicily.

A different karyological form with an acrocentric X was described in south-eastern Italy (Monte Gargano) (Niethammer 1981) and later classified as *M. savii savii* on the basis of tooth morphology (Brunet-Lecomte 1988). As no banded karyotype was reported, nothing can be said about the general level of autosomal similarity with the other karyotypes.

For a better knowledge of the level of chromosome polymorphism within the *Microtus savii* complex (according to Santini 1978), further investigations on C- and G-banded karyotypes of specimens from different Italian populations were carried out in this study.

Material and methods

Specimes were trapped at different localities (Fig. 1): Ficuzza (Palermo, Sicily; 1 female (F); Fiume Freddo (Cosenza, Calabria; 1 F); Metaponto (Potenza, Basilicata; 1 F), Monte Cimone (Modena, Emilia; 1 F) and Parco Lambro (Milano, Lombardia, 1 male (M)).

Fig. 1: Collecting sites of specimens reported in the present paper (open symbols) and in literature (filled symbols) (Krapp & Winking 1976; Niethammer 1981; Galleni et al. 1992). Square: *Microtus brachycercus*; circle: *Microtus savii* (X metacentric); triangle *Microtus savii* (X acrocentric).

Chromosomes were prepared from fibroblast cultures of short terminal tail biopsies (Stanyon & Galleni 1991) and C-, G-banded following previously reported techniques (Galleni et al. 1992).

Results

The G-banded karyotype of specimens from Ficuzza (PA) Monte Cimone (MO) and Parco Lambro (MI) matched that of *Microtus savii* from central Italy while the G-banded chromosomes of the female from Fiume Freddo (CS) agreed with those previously found in *Microtus brachycercus* (see Galleni et al. 1992).

The female from Metaponto exhibited the same autosomal pattern of the other specimens but an acrocentric medium size X chromosome which differed from the metacentric X of *Microtus savii* (Fig. 2).

Autosome C-banding pattern was the same in all the specimens surveyed except a larger amount of pericentromeric heterochromatin in the third chromosomes pairs of specimens with the *M. savii* X metacentric karyotype (Fig. 3).

A centromeric C-band, a band in the middle of the arm and a third band about half way between them were detected in the X chromosome of the female from Metaponto (Fig. 4). All the other specimens showed C-banded karyotypes similar to those described in Galleni et al. (1992).

Fig. 2: G-banded karyotype of a female *M. savii* from Metaponto (PZ).

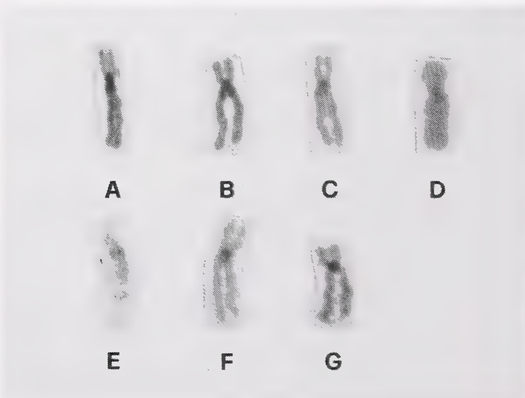

Fig. 3: C-bands of chromosome 3 (A = Milano; B = Viterbo; C = Pisa; D = Monte Cimone; E = Metaponto; F = Rosarno; G = Fiume Freddo).

Discussion

Morphological, karyological data and hybridological tests showed that the Savi pine vole of the Italian peninsula actually is a heterogeneous group including two different species in an early stage of speciation: *M. savii* in north and central Italy and *M. brachycercus* in the south-west (Galleni et al. 1994, Galleni 1995). The

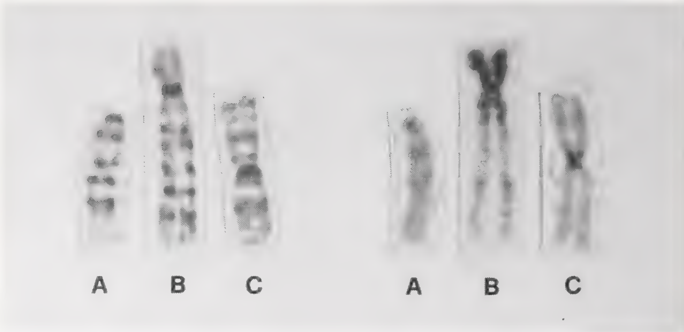

Fig. 4: G-banded (left) and C-banded (right) X chromosomes of *M. savii* (A: acrocentric, C: metacentric) and *M. brachycercus* (B).

question of the taxonomic state of populations from different localities of southern Italy and Sicily is still open however.

The agreement between karyotypes of specimens from northern and central Italy (Parco Lambro and Monte Cimone) and that of the specimen from Sicily supports the classification suggested by Krapp & Winking (1976) who considered these populations as all belonging to the subspecies *M. savii savii*. It appears, in this case, that allopatric distribution has not been followed by differentiation at specific level at least in respect of morphological and karyological traits.

The presence of specimens with the same karyotype as *M. brachycercus* at Fiume Freddo (Calabria) confirms the occurrence of this species in the Calabrian peninsula.

The X-acrocentric karyotype of the female from Metaponto (Potenza) is similar to that described by Niethammer (1981) for a specimen from Monte Gargano (Foggia). Because of the proximity of the two collecting sites (Fig. 1) it is likely that we are dealing with the same form.

Hypotheses on the relationships between the metacentric X chromosome of *M. savii* and the sub-metacentric X of *M. brachycercus* were discussed previously (Galleni et al. 1992). A similarity of G-banding pattern between the euchromatic part of X chromosome long arm of *M. brachycercus* and the whole metacentric X of *M. savii* was also confirmed in this study (Fig. 4). The acrocentric X chromosome is similar to the metacentric X but it is not possible to resolve the bands to ascertain if a pericentric inversion took place in the X of *M. savii* generating the acrocentric form.

According to the taxonomic revision based on tooth morphology (Brunet-Lecomte 1988) the forms of *M. savii* with different X chromosomes would belong to the same species. However no crosses have been carried out so far to confirm this view. Up to date a clear speciation process has been demonstrated only for karyomorphs (*M. savii* and *M. brachycercus*) with different heterochromatin composition of their sex chromosomes, although unequivocal evidence of an active role of this class of chromatin in the formation of reproductive barriers has not been demonstrated yet (Galleni et al. 1994).

Finally, heterochromatin polymorphism observed for the third chromosome will be a useful marker for studying phyletic relationships among the different forms of

this group if confirmed on a wider sample. However, this polymorphism does not exceed the level of polymorphism found in many other mammalian species and is not considered to affect fitness.

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Zusammenfassung

Innerhalb des *Microtus savii* Komplexes können 2 Arten unterschieden werden: *M. savii* im beschriebenen Areal und *M. brachycercus* in Kalabrien. Die beiden Arten befinden sich in einem frühen Stadium der Artbildung. Karyologische Analysen von Individuen eines weiteren geographischen Gebietes bestätigten das Vorkommen von G-gebänderten Karyotypen von *M. savii* in Nord-Zentral-Italien und auf Sizilien. G-gebänderte Karyotypen von *M. brachycercus* wurden in Kalabrien gefunden und eine dritte Chromosomenform mit einem akrozentrischen X in Süd-Ost-Italien. Die C-gebänderten Karyotypen bestätigten die Homogenität der autosomalen C-Bänderung, zum Teil von einer kleinen Variante im dritten Chromosomenpaar, und eine Variation der C-Bänderung in den Geschlechtschromosomen.

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Reproduction in *Mus macedonicus* (Mammalia: Rodentia) in the Balkans

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Abstract. The material of 538 specimens of *Mus macedonicus* was collected during 1983—1994 in 64 localities in northern Greece, southern Bulgaria and former Yugoslav Macedonia. Duration of the breeding period, sexual maturation in relation to the body weight, proportion of sexually active individuals in the population, intensity of reproduction, litter size, and embryonal resorption were evaluated. Reproduction had distinctly seasonal character. Litter size was between 4 and 10, $\bar{x}$ = 6.73 (n = 45). Our results in *Mus macedonicus* were compared with the published data on other free living mice species of the genus *Mus* in the western part of the Palaearctic region.

Key words. *Mus macedonicus*, wild mice, reproduction, litter size.

Introduction

Mus macedonicus Petrov & Ružić, 1983, is a strictly free living mouse species inhabiting the south of the Balkan Peninsula (Orsini et al. 1983, Vohralík & Sofianidou 1987, 1992), as well as the large territories of the Middle East extending from Turkey, to Armenia and Azerbaijan in the north, to Iran in the east, and to Israel in the south (Kratochvíl 1986, Auffray et al. 1990b, Orlov et al. 1992). Despite its large distribution area it was recognized as a distinct species only in the 1980s, when a considerable research effort was devoted to the taxonomy of *Mus musculus* sensu lato. Due to this fact, hitherto studies dealing with *Mus macedonicus* were confined mostly to problems associated with systematics and taxonomy, e. g., biochemical systematics (Bonhomme et al. 1984), karyology (Orlov et al. 1992), morphology (Orsini et al. 1983, Kratochvíl 1986, Gerasimov et al. 1990, etc.), and behaviour (Frynta et al. 1992).

Despite that its specific status was accepted universally, there is no agreement about its valid name. So far, the following names were suggested successively: *Mus abbotti* Waterhouse, 1837, *Mus tataricus* Satunin, 1908, *Mus spretoides* Thaler, 1983 (nomen dubium, suggested by Bonhomme et al. 1984), *Mus macedonicus* Petrov & Ružić, 1983. Recently, the validity of the three former names has been cast into doubt (cf. Marshall 1986, Auffray et al. 1990a) and the later one was suggested by Musser & Carleton (1993) as currently valid name. Although it is much probable that the taxonomic revision of all *Mus* taxa described from the distribution range of the species will reveal older valid names, we follow the above authors and use the name *Mus macedonicus* here.

There is fairly good information on the reproduction in at least two free living mice species of western Palaearctic. The most extensive data are available about the Mound building mouse, *Mus spicilegus*. From the 1940s it was studied by various authors in south Ukraine and Moldavia, and the results were summarized in the

book by Sokolov et al. (1990). Valuable information is also contained in the monography by Mikeš (1971) who studied in detail its ecology in the Vojvodina region, Yugoslavia. The other, thoroughly studied species was *Mus spretus* that received considerable attention only recently, in Spain and France (e. g., Vargas et al. 1984, 1986, 1991, Cassaing & Croset 1985, Durán & Sans-Coma 1986, Durán et al. 1987). Other free living mice populations the taxonomic status of which, unfortunately, remains unclear were studied extensively in Kazakhstan, Central Asia (Borisenko 1977). Also *Mus musculus* populations collected in fields in former Czechoslovakia by Pelikán (1974) could be included among free living mice. In the south of the Balkans, the only comprehensive study on the biology of free living mice populations (Straka 1966) suffers from the unclear specific status of the used material, that may be composed from three mouse species, at least.

According to our knowledge, the only data on the biology of reproduction in *Mus macedonicus* are few records on litter size from southern Bulgaria by Markov (1964) who referred this mouse to *Mus musculus hispanicus*. Therefore, the aim of this study is to provide a basic information about the reproductive biology in *Mus macedonicus* and to compare it with that in other free living mice species from the western part of the Palaearctic region.

Material and methods

Altogether, 538 specimens of *Mus macedonicus* captured during the period 1983—1994 in 64 localities in the south of the Balkan Peninsula, were used in our analysis. Most of the material was collected in northern Greece: 34 localities in Macedonia (275 specimens), 17 localities in Thrace (186 specimens) and 3 localities in Epeirus (9 specimens). For details about localities, date and number of specimens collected in most of the above material see Vohralík & Sofianidou (1987, 1992) and Sofianidou & Vohralík (1991). Additional 30 specimens were collected in 4 localities of southeastern Bulgaria (Krumovo, district Jambol; Dâbovec and Knižovnik, district Chaskovo; Sozopol, district Burgas), 27 specimens in 3 localities of southwestern Bulgaria (Sandanski, Strumjani and Baldevo, district Blagoevgrad) and 11 specimens in 3 localities (Star Dojran, Pretor and Vozarci) in former Yugoslav Macedonia. All the material is deposited in collections of the Department of Zoology, Charles University, Prague.

Mice were obtained mostly by snap traps. Body weight was recorded to the nearest gram. Next, mice were dissected and the condition of their reproductive organs was ascertained.

Embryos were counted macroscopically and their length (in the longitudinal axis) was measured. The presence of placental scars was also recorded. Embryos which were conspicuously smaller than the remaining ones in the set, were considered to be resorbed. Weight of embryos in the set was estimated according to Zejda (1968). Net body weight of pregnant females (i. e., without weight of embryos) was used in further analysis.

The term "mature" females is used for specimens which already have taken part in the reproduction, being either actually pregnant, lactant, or with placental scars. Females not participated in reproduction as yet, were considered to be "immature".

Testis (length and width) were measured with the precision to the nearest 0.1 mm, and length of vesicular glands (from the point of their fusion to their outmost margin) to the nearest millimetre. Area of cross-section of the testes (AC-ST) was used as a criterion of sexual activity. It was computed using formula: AC-ST [mm^2] = testis length [mm] * testis width [mm] * 3.1415 * 1/4. We considered males showing values of AC-ST > 25 mm^2 to be sexually active. This arbitrary criterion was determined on the basis of relationships between AC-ST and the length of vesicular glands in specimens collected in May. In spring and summer there is a full correspondence between the terms sexually mature and sexually active males. However, in autumn and winter samples mature males affected by testes regression are sexually inactive.

Results

Sexual maturation in relation to body weight

Intensity of sexual maturation process was expressed as increase in the proportion of mature specimens within subsequent weight categories in the material collected during the period of intensive reproduction (i. e., May to August period in our material).

Lightest mature males weight 12 g. Four of nine specimens (44 %) belonging to weight category 11—12 g were mature (Table 1). In the total material of the following three weight categories (13—18 g) only a small proportion of males (7 %, n = 55) remained immature. No immature specimens were found among males exceeding the weight of 18 g (n = 25).

Maturation process in females seems to start earlier than that in males (Table 1). The lightest sexually mature female had 10 g. For subsequent weight categories an intensive maturation was typical. As many as 65 % of 20 females between 11 and 16 g were mature. Within weight categories above 16 g, proportion of mature specimens attained the maximal level, with only 8 % (n = 60) remaining immature. However, it is most probable that the real percentage of mature females in our material was slightly underestimated due to following reasons. Among immatures were included also primiparous females during the first five days of their pregnancy, when it is not possible to simply recognize gravidity by means of the macroscopical examination of the uterus (cf. Pelikán 1974). Also, mature females which had participated in reproduction several months before, but had remained sexually inactive in the last months could have been exceptionally scored as immature.

Proportion of sexually active males

The proportion of sexually active males gradually decreased during the course of the period May to December (Fig.1). The highest percentages of sexually active males were found in May (87 %, n = 37) and June (91 %, n = 11), i. e., in the period in which overwintered, sexually active males highly predominated over males born in

Table 1: Proportion of sexually mature males and females within the individual weight categories during the period of intensive reproduction (May to August).

Body weight	Males (n = 100)			Females (n = 90)		
	n	mature	%	n	mature	%
5— 6	2	0	0	1	0	0
7— 8	3	0	0	1	0	0
9—10	6	0	0	8	1	13
11—12	9	4	44	4	2	50
13—14	10	9	90	7	6	86
15—16	11	9	82	9	5	56
17—18	34	33	97	11	10	91
19—20	17	17	100	19	16	84
21—22	8	8	100	18	18	100
23—24	0	—	—	9	8	89
25—26	0	—	—	3	3	100

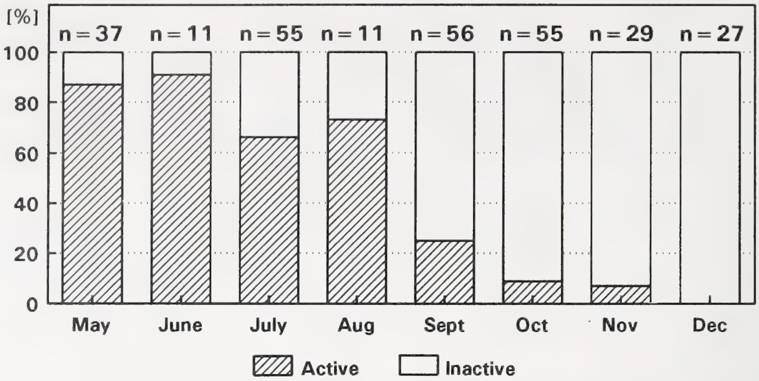

Fig. 1: Variation in the proportion of sexually active males in *Mus macedonicus* during the period May to December.

the current year. As a result of the continual appearance of young, immature individuals, the proportion of sexually active males decreased in July and August to 66 % (n = 55) and 73 % (n = 11), respectively. In the following months the decrease continued owing to mass occurrence of young animals, decreased intensity of maturation, and testes regression in mature males. Corresponding values in September, October and November were 25 % (n = 56), 9 % (n = 55) and 7 % (n = 29), respectively. All males captured in December (n = 27) were already inactive.

Proportion of sexually mature females

Proportion of mature females (Fig. 2) was highest in May 95 % (n = 21). Distinct decrease in the following months was a result of mass occurrence of young animals during the summer (June 64 %, n = 11, July 70 %, n = 57, August 75 %, n = 8). Autumnal drop (September 42 %, n = 62, October 40 %, n = 38, November 22 %, n = 23, December 21 %, n = 24) can be attributed in addition to the above factor also to the selective mortality of mature animals and the termination of the maturation process at the end of the breeding season.

Duration of breeding season

Due to the lack of the material from the January to April period, the only information available on the beginning of the breeding season can be based on the age estimation in current year specimens collected in May. The best for this purpose seems to be a sample of 48 animals collected during the period 3—11 May 1994 in three localities of Macedonia, Greece. The young, in the current year born individuals were identified among them according to their lower body weight, small body dimensions, fur coloration, and in males also according to considerably smaller length of vesicular glands. Altogether, we found five current year specimens in this sample. The biggest among them were a male (body weight 16 g) and a female (14 g) which was already pregnant (length of embryos 3 mm). According to our knowledge on postnatal growth in laboratory born *Mus macedonicus* (D. F., unpublished data), the birth date of these two specimens can be estimated approxi-

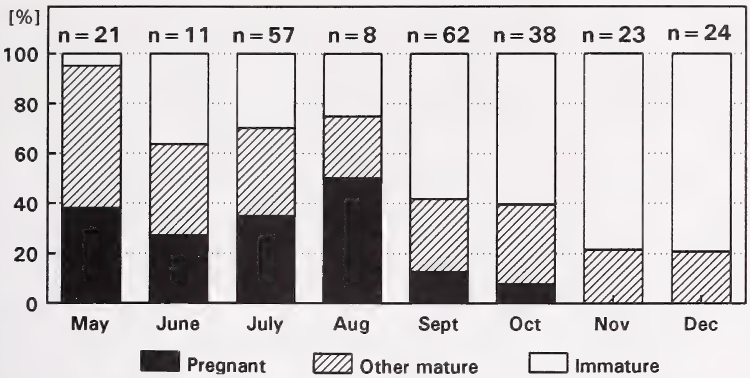

Fig. 2: Variation in the proportion of mature and pregnant females in *Mus macedonicus* during the period May to December.

mately to the beginning of March and consequently, their conception to mid February.

The end of the breeding season was put to October when last pregnant females were collected (Fig.2). They composed small proportion only among mature (20 %, n = 15) as well as among all captured females (8 %, n = 38). Last pregnant females were from the 10th, 18th and 20th October, and their embryos measured 11, 15 and 16 mm, respectively. These data suggest that parturitions take place till the end of October. Therefore, the duration of the breeding season could be estimated at about 8½ months (i. e., mid February — late October). However, we ought to keep in mind that the length of the breeding period can vary between years and that our estimation of its beginning is based on data obtained in a single year only.

Breeding intensity

The reproduction in Balkan populations of *Mus macedonicus* has distinctly seasonal character. The breeding intensity during the year was expressed as proportion of pregnant among all the females in the sample. As evident from Fig.2, this proportion was fairly high during the spring—summer period (May 38 %, n = 21; June 27 %, n = 11; July 35 %, n = 57; August 50 %, n = 8). Marked drop in breeding intensity was recorded in September (13 %, n = 62) and October (8%, n = 38). Pregnant females were not present in November (n = 23) and December (n = 24) samples.

Breeding intensity can also be given as percentage of pregnant among mature females. This percentage was also high throughout the entire spring—summer period (May 40 %, n = 20; June 43 %, n = 7; July 50 %, n = 40; August 67 %, n = 6). Its rapid decrease was observed from September (31 %, n = 26) till the end of the breeding season (October 20 %, n = 15).

Litter size

In 45 visibly pregnant females, the litter size (i.e., all visible embryos in the set, including the resorbed ones) varied within the range 4—10, $\overline{x} = 6.73$ embryos (S. E. = 0.23). The value represents the annual mean of all females, irrespective of

Table 2: Variation in litter size during the period May to October including embryos affected by resorption (mean indicated by asteric was computed for unresorbed embryos only).

Month	n	4	5	6	7	8	9	10	Mean	Mean*
May	8	0	0	0	3	3	0	2	8.13	8.00
June	3	0	0	1	1	1	0	0	7.00	7.00
July	20	2	4	6	5	1	1	1	6.30	6.10
August	4	1	0	0	2	1	0	0	6.50	6.50
September	7	1	0	4	0	1	0	1	6.57	6.29
October	3	0	0	2	1	0	0	0	6.33	5.00
Total	45	4	4	13	12	7	1	4	6.73	6.49
% (S. E.)	—	9	9	29	27	16	2	9	(0.23)	(0.26)

Table 3: Variation in resorption rate during the period May to October. Explanations: SLA = size of litters affected (numbers of resorbed embryos are given in parentheses). Percents were computed for two-months periods.

Month	sets	affected	%	embryos	affected	%	SLA
May	8	1		65	1		7(1)
June	3	0	9.1	21	0	1.16	
July	20	2		126	4		10(2) 5(2)
August	4	0	8.3	26	0	2.63	
September	7	1		46	2		6(2)
October	3	2	30.0	19	4	9.23	7(1) 6(3)
Total	45	6	13.3	303	11	3.63	

date and the locality of capture. If only unresorbed embryos were counted, the corresponding mean litter size was 6.49 (S. E. = 0.26).

Variation in litter size during the year is given in Table 2. Despite very low sample sizes, one-way analysis of variance revealed significant variation of litter size between the two months periods ($F = 4.505$; $P = 0.0169$, non-resorbed embryos only). Tukey test confirmed that the mean litter size in May to June (7.73, n = 11) is significantly higher than the corresponding values both in July to August (6.17, n = 24) and in September to October (5.90, n = 10). It is to be remarked here, that the mean net body weight of pregnant females was almost identical in all the above periods ($F = 0.198$; $P = 0.8213$) and the effect of season on litter size even increased when the body weight was introduced as covariate into ANOVA model ($F = 4.758$; $P = 0.0149$).

In the total of 45 visibly pregnant females, 6 embryo sets (13.3 %) were affected by resorption. In two cases, only one embryo was affected, in three cases, two embryos. In one case, even three of six embryos in the set were resorbed. In total, only 11 of 303 embryos examined were affected (3.63 %). Resorption rate showed slightly higher values at the end of the breeding season (Table 3).

Discussion

There is a general agreement between our findings in *Mus macedonicus* and observations reported by most authors studying free living mice populations (*Mus spicilegus*: southern Ukraine, Naumov 1940, Vojvodina, Mikeš 1971; *Mus* sp.: Kazakhstan, Borisenko 1977; *Mus musculus*: field populations in Czechoslovakia, Pelikán 1974, 1981) that the majority of individuals of both sexes attain their sexual maturity in the size ranging between 10 and 14 grams. Also our estimation concerning the duration of the breeding season in *Mus macedonicus* (mid February to late October) corresponds fairly with data available on other free living mice species. In various populations of *Mus spicilegus* in southern Ukraine the following breeding periods were found: mid March to October (Sokolov et al. 1990), early February to October (Pisareva 1948) and mid April to October (Naumov 1940). For the same species from Vojvodina Mikeš (1971) reported the period March to November. Similarly, a breeding season lasting from February to October was reported in *M. spretus* from southern Spain (Vargas et al. 1991). In general, we can conclude that a seasonal reproduction period with an interruption during winter months appears to be a common phenomenon in all free living mice populations of the western Palaearctic, studied so far.

Comparing the proportion of pregnant among all the females collected during the period of most intensive reproduction (May to August), it is evident that the value found in our material of *Mus macedonicus* (36.1 %, n = 97) is closest to those in *Mus spicilegus* from Vojvodina (36.7 %, n = 120, Mikeš 1971), while the value reported in *Mus spicilegus* from southern Ukraine (50.0 %, n = 204, Sokolov et al. 1990) is considerably higher.

Mean litter size in our total material of *Mus macedonicus* (6.73) is practically the same as the value computed from the data published by Markov (1964), who had at his disposal a sample collected during 1960—1962 in southern Bulgaria (mean = 6.75, range 3—9, n = 16). Fairly close values were reported in populations of *Mus spicilegus* from S Ukraine (6.7, n = 189, Sokolov et al. 1990; 6.9, Naumov 1940), as well as in free living mice captured in Bulgaria (6.53, range 3—10, n = 132, Straka 1966). Slightly higher values were reported in *Mus spicilegus* from Vojvodina (7.30, range 2—15, n = 56, Mikeš 1971) and in field populations of *Mus musculus* from Czechoslovakia (7.85, range 4—12, n = 67, Pelikán 1974). Similar span of the average litter size was found in free living mice populations collected in different parts of Kazakhstan. Corresponding values in the populations from districts Aktjubinsk and Ural (Borisenko 1977), Kustanaj and Turgajsk (Borisenko 1964) and Alma-Ata (Machmutov 1970) were 6.8 (n = 17, range 5—10), 7.7 (n = 68, range 1—14) and 7.0 (n = 65, range 5—11), respectively. On the other hand, mean values of net litter size (i. e., without resorbed embryos) reported in *Mus spretus*, 5.0 (Durán et al. 1987) and 5.53 (n = 193, range 2—10; Vargas et al. 1991) are distinctly smaller than average net litter size 6.49 found in our material of *Mus macedonicus*. Comparing above differences we ought to keep in mind the general tendency in rodents to decrease their litter size in east-west, conceivably also in north-south directions in Europe. For example, in the Wood mouse, *Apodemus sylvaticus* the differences in mean litter size between populations from the Iberian Peninsula and the Balkans (Frynta & Vohralík

1992) are nearly the same as those given above in free living mice. However, it has to be mentioned here that Pelikán (1974) found similar differences also between field (7.85, n = 67) and commensal populations (5.58, n = 183) of *Mus musculus* in Czechoslovakia, which fact suggests that not only latitude and longitude, but also habitat can considerably affect the litter size in murine rodents.

It is of interest that the May—June peak in mean litter size found in our material of *Mus macedonicus* has a parallel in an April—May peak reported by Vargas et al. (1991) in *Mus spretus*. They attributed this phenomenon to the higher age of over-wintered females prevailing in the population during this period. On the contrary, highest mean litter size values were found during the June—August period in *Mus spicilegus* of southern Ukraine (Sokolov et al. 1990).

Although the percentage of resorbed embryos in our material of *Mus macedonicus* (3.63 %, n = 303) is twice as high as corresponding values 1.57 % (n = 1068) reported by Vargas et al. (1991) in *Mus spretus* or 1.87 % (n = 536) reported by Pelikán (1974) in field populations of *Mus musculus* in Czechoslovakia, the sample size in our material is too small and seasonal variation too high for any further conclusion.

Basing on above comparisons we can conclude that, in general, the reproduction pattern in *Mus macedonicus* resembles that reported in other free living mice species of the western Palaearctic.

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Zusammenfassung

Die Fortpflanzung von *Mus macedonicus* wurde an 538 Exemplaren dieser Art von 64 Standorten in Nordgriechenland, Südbulgarien und Mazedonien untersucht. Gegenstände der Untersuchung waren: Länge der Fortpflanzungszeit, Geschlechtsreife im Bezug zum Körpergewicht, Anteil geschlechtsreifer Individuen in der Population, Fortpflanzungsintensität, Wurfgröße, Embryonalresorption. Die Fortpflanzung von *Mus macedonicus* trägt ausgeprägten Saisoncharakter, die Wurfgröße beträgt 4—10, $\bar{x} = 6.73$ (n = 45). Die gewonnenen Erkenntnisse wurden mit Literaturangaben über andere freilebende Mäuse der Gattung *Mus* in Europa und Mittelasien verglichen.

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Two new chameleons (Sauria: Chamaeleonidae) from isolated Afromontane forests in Sudan and Ethiopia

Colin Tilbury

Abstract. Two new species of horned chameleon are described from isolated montane forests in eastern Africa. In one of the species, the male has a unique rostral cone unlike any other known chamaeleonid rostral appendage, and in the other, paired annulated rostral horns are present, a feature previously regarded as unique to a group of west African chameleons.

Key words. Reptilia, Chamaeleonidae, Sudan, Ethiopia, new species, taxonomy, zoogeography.

Introduction

The forests of the Afromontane Archipelago serve as centres of endemism for plants and animals in Africa. It comes as no surprise that isolated and consequently little explored areas of montane forest should still produce new species of reptile.

In 1988 the chameleons in the spirit collection of the National Museum of Kenya (Nairobi) were examined. Amongst the specimens a single adult male chameleon was found that originated from the Imatong Mountains in southern Sudan. Its uniqueness was evident by its long non-annulated conical rostro-nasal projection. At the time it was hoped that further specimens of this form could be obtained to allow a more detailed analysis, but due to the civil unrest prevalent in that region, it seems unlikely that further specimens of this chameleon will be collected in the near future and therefore this species *Chamaeleo* (*Trioceros*) *conirostratum* n. sp. is described on the basis of this single adult male holotype.

Malcolm Largen (1995) described a new species of chameleon *Chamaeleo harennae* from the Harenna Forest in Ethiopia on the basis of two specimens — an adult female and an unsexed juvenile LIV 1986.212.245. The latter specimen had been found dead, desicated, severely damaged — presumably by a bird — and not in good condition. However it showed some significant differences from the adult specimen in having more heterogeneous scalation and was also noted to possess two tiny rostral tubercles. Largen felt that the observed differences were likely to be a consequence of its immaturity. Since males of a species may possess cranial ornamentation not exhibited by females, the possibility that the juvenile was a male and the adult specimen being a female, would allow that the two could still be conspecific. However on examining the photograph of the adult specimen, well developed hemipenal bulges are evident, suggesting that the hornless holotype is in fact an adult male. Since this would effectively negate the possibility that the juvenile was a horned female, the probability was high that the two specimens in fact represented two distinct taxa. During the course of 1996, a trip was made to the Harenna Forest to test this hypothesis, that resulted in the collection of a good type series of a new

chameleon *Chamaeleo* (*Trioceros*) *balebicornutus* n. sp. and 4 additional adult specimens of *Ch. harennae* (one male and three females).

Chamaeleo* (*Trioceros*) *balebicornutus n. sp. (Fig. 1)

Diagnosis: A small chameleon with markedly heterogeneous scalation. Each canthal ridge terminates in an annulated horn that is closely aligned to the opposite horn and projects forward over the upper lip. The horns are well developed in the males, and attenuated in females. The casque is flat and has a distinct shallow notch at the occiput. There are no obvious parietal or temporal crests. Gular crest is strong and the dorsal crest is limited to the anterior 2/3 of the keel. Ventral crest is represented by a line of white tubercles. The tail is smooth.

Derivatio nominis: The name derives from the fact that this is the only two-horned chameleon inhabiting the Bale Mountains.

Holotype: ZFMK 63049, adult male, collected 2nd October 1996 by Colin Tilbury and Stephen Spawls, Katcha clearing, altitude 2400 metres, Harenna Forest, Bale Mountains, central Ethiopia 06°42'N 39°44'E.

Paratypes ZFMK 63050-58 collected by Tilbury and Spawls, 21st September and 2nd October 1996 from roadside vegetation between 1700 m and 2100 m 06°37'N 39°44'E and LIV 1986.212.245 from 1980m 06°40'N 39°44'E collected by M. J. Largen on 7th August 1986.

Table 1: Morphometric variation in the holotype and paratypes of *Chamaeleo* (*Trioceros*) *balebicornutus* n. sp. — * Measurements in millimetres. s/v = snout/vent length; c/snt = casque tip to snout length; i.o.d. = inter-orbital diameter; com/snt = commissure of mouth to snout distance; c/com = casque to commissure distance; g/cr = number of cones in the gular crest; d/cr = number of cones and pointed tubercles in the dorsal crest. — Mus No. = Museum accession number in the ZFMK Bonn, Germany. — MM = adult male, FF = adult female, jm = juvenile male, jf = juvenile female.

Mus No.	Sex	s/v*	Tail*	horn*	c/snt*	i.o.d.*	com/snt*	c/com*	g/cr	d/cr
Holotype 63049	MM	76	86	4.5	20.0	8.5	14.0	12.0	18	21
63050	MM	65	87	4.0	19.5	8.5	13	11.5	20	25
63051	MM	62	80	4.0	19	8.5	13	11.5	23	14 (d)
63052	FF	70	83	1.0	21	8.5	12	13	12	25
63053	FF	59	71	1.0	18	8.0	13	11	15	23
63054	FF	70	80	1.0	19	8.5	13.5	12.5	10	19
63055	FF	75	84	1.5	19.5	8.0	14	12	20	22
63056	FF	72	83	2.0	20	8.0	13.5	12.5	11	30
63057	jm	37	48	1.0						
63058	jf	32	37							

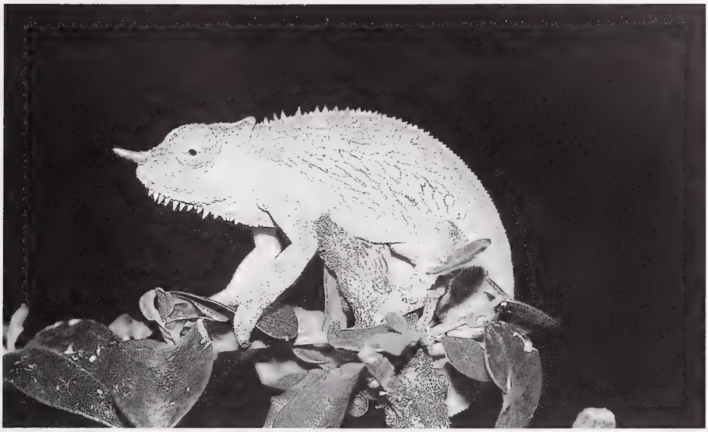

Fig. 1: Adult male of *Chamaeleo* (*Trioceros*) *balebicornutus* n. sp. from the Harenna forest, Ethiopia.

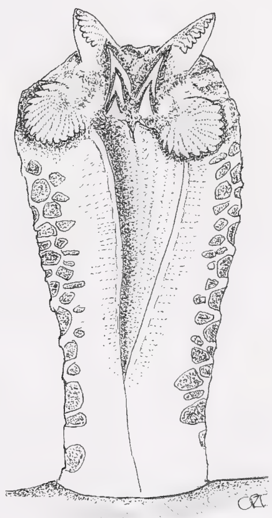

Fig. 2: Sulcal view of the hemipenis of the holotype of *Chamaeleo* (*Trioceros*) *balebicornutus* n. sp.

Description of the holotype: A small chameleon with a total length (TL) of 162 mm. Casque flat. No parietal crest. The lateral crests terminate posteriorly in two large pointed tubercles on each side of the casque giving it a swept up appearance and causing the posterior edge of the casque to be shallowly notched in the midline. There is no temporal crest. The supra-orbital crest has a dentate appearence. The canthal ridges are smooth and each side terminates in an annulated horn which projects forward for 4 mm at an angle of 10° from the horizontal. The

two horns are tightly opposed to each other. The nare is sited midway between the anterior orbital rim and the tip of the snout, opens inferiorly and has no indication of a nasal bulge. Gular crest composed of 18 elongated white conical tubercles, largest anteriorly and becoming progressively smaller posteriorly. The gular area is incised by 4 shallow grooves that are most noticeable posteriorly and enclose a few islands of enlarged oval tubercles. Dorsal crest composed of 8 large cones, largest anteriorly and followed by a rapidly diminishing series of pointed tubercles to fade completely by about $^2/_3$ of the way along the keel. There is no crest on the tail. The gular crest is followed posteriorly by a midline ventral row of white tubercles that extends a short way beyond the vent. Scalation heterogeneous with large flattened platelike tubercles 2—3 times the diameter of the surrounding tubercles, profusely scattered over the flanks forming several vague rows. Tail and belly covered with finer sub-homogeneous granules. Eyeball skin coated with fine homogeneous granules. The tail is longer than the snout/vent length, comprising 53 % of the TL.

Hemipenis: (Fig. 2). Club-shaped. Truncus is set with shallow simple calyces, the most prominent being on the proximal aspect of the asulcal side. The sulcal lips are almost smooth. The apex is adorned with 2 pairs of similarly sized rotulae with finely dentate free margins. The asulcal pair are orientated almost vertically while the sulcal pair are orientated horizontally towards the sulcal side. Between each of the sulcal and asulcal rotulae is a row of 2—3 large thornlike papillae curved toward the asulcal side.

Colour in life: Holotype — Background a light moss green. Flank tubercles divided into many vague rows by dark interstitial skin. A dark patch is present over the dorsal keel at the nape and pelvis and between these, two broad hourglass shaped dark blotches extend from the keel to the belly overlain by green tubercles. Top of head and temporal area pale off-white. Lower labials pale blue. Limbs blotched with dark brown, as is the tail. Belly off-white to green. Eyeballs with 8 radiating lines. Gular crest white. Anterior dorsal crest spines a rich brown chocolate colour.

Female colour: Background pale to bright green. Dorsal crest spines dark orange as are the lateral/supra-orbital crests and the tip of the snout. Gular crest white. No radiating lines on the eyeball. Belly crest indicated only by a faint white line.

Variation: (Table I) Little variation of any significance is seen amongst the chameleons. The gular crest varies between 18—23 cones and the number of cones and pointed tubercles in the dorsal crest varies between 14 to 25. Sexual dimorphism is seen in the development of the annulated horns which are much smaller in the female, and in the smaller average number and reduced prominence of the gular cones. The rostral projections are clearly seen in even the smallest specimens.

Reproduction: ZFMK 63056 was dissected and found to contain 16 eggs (6 in the left oviduct and 10 in the right). These averaged 8 mm x 6 mm in size.

Habitat: Broadleafed undifferentiated Afromontane rain forest between 1500 m — 2400 m. The Harenna forest cloaks the southern slopes of the Bale Mountains. The tops of the tallest trees reach up to about 40—45 metres with the dominant species including *Aningeria adolfi-friedericii* and *Podocarpus latifolius* in the lower elevations and *Hagenia abyssinica* and *Schefflera abyssinica* at the higher reaches of

this chameleon's range. The chameleons are found in the lower shrub layer of the forest at perch heights varying between 1.5 metres and 5 metres above the ground. The holotype was collected at a height of approximately 5 metres in a tall specimen of *Hypericum revolutum* near a rivulet at the edge of a large grassy glade (Katcha clearing).

Notes: The Bale mountains form an important centre of endemism in Ethiopia. In addition to *Ch. (T.) balebicornutus* n. sp., two other species of chameleon are known from these mountains. The recently described *Ch. harennae* occurs chiefly in the upper reaches of the Harenna forest between 2400 metres and the upper forest line at about 3300 metres. Here it extends into the giant heathers and ericaceous shrubs. The two species are sympatric in the zone around 2400 metres where they both share the same type locality (Katcha clearing). *Ch. (T.) balebicornutus* n. sp. differs chiefly from *Ch. harennae* in the presence of paired rostral horns in both sexes, a more heterogeneous scalation and in the complete absence of a parietal crest. The tail is also smooth. The third species *Chamaeleo (T.) affinis* was not found in the Harenna forest but rather on the northern slopes of the mountains at elevations up to at least 2700 metres. This species has a much finer scalation with no trace of a rostral projection, and either no gular crest or a pair of low gular ridges.

Taxonomic affinities: The arrangement of the rostral horns in *Ch. (T.) balebicornutus* n. sp. is unusual in that all other species with paired annulated horns are strictly west African forms. This, coupled with the absent parietal and temporal crests (also characteristics of the west African *Ch. cristatus* group (Klaver & Böhme 1992) suggests a west African splinter radiation. This is not however borne out by the affinities of the other herpetofauna of the Ethiopian highlands, which show nothing in common with either the west or central African forests, and are largely unique with a high rate of endemism. In Tanzania, *Ch. (T.) deremensis* shares some features with *balebicornutus* n. sp. in that it also lacks a parietal and temporal crest, but has no gular crest and 3 annulated horns.

Chamaeleo (Trioceros) conirostratum n. sp. (Fig. 3)

Diagnosis: The adult male chameleon is recognised by a unique rostral process comprising of an elongated non-annulated cone 3 mm in length which appears to be attached to a pliable base. The tail is slightly shorter than the snout/vent length. The general habitus, shape of the casque and stucture of the parietal crest ally this taxon to the *Ch. bitaeniatus* (sensu lato) group.

Derivatio nominis: The name *conirostratum* derives from the unique shape and position of the rostral process.

Holotype: NMK L/1949, an adult male collected by Parker and Stubbs in 1982 from Lomoriti, at 3500 feet a.s.l., south west Imatong Mountains, southern Sudan 03°54'N 32°43'E.

Description: A small chameleon with a total length of 130 mm. Casque narrowly elevated and peaked posteriorly. Parietal crest distinct, forks anteriorly with a few small tubercles continuing in a midline row between the orbits. The temporal crests

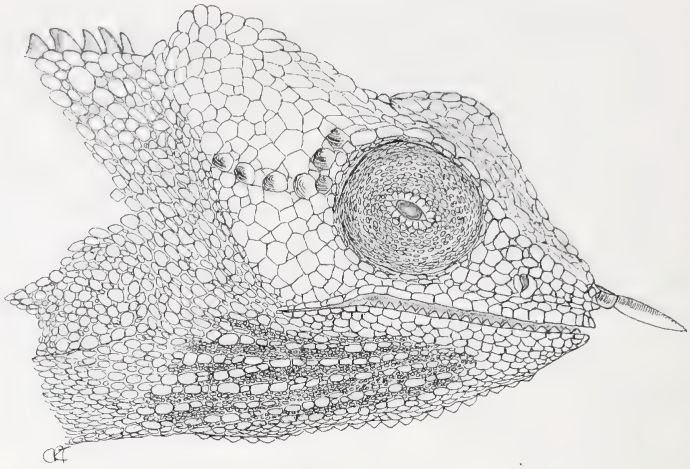

Fig. 3: Detail of the head of the adult male holotype of *Chamaeleo* (*Trioceros*) *conirostratum* n. sp. from Lomoriti, Imatong mountains, southern Sudan.

are distinct, comprising 4 enlarged tubercles on each side. The canthal ridges are edged in enlarged, but smooth oval scales (5 on the left and 6 on the right). The canthal ridges merge anteriorly to end in the base of an elongated non-annulated thin cone projecting 3 mm off the front of the upper lip. The base of the cone appears to be pliable (In the preserved specimen this appendage is bent downwards and to the left side over the tip of the snout — possibly an artefactual state caused at the time of preservation). There are no traces of any pre-orbital projections. The nares open facing directly posteriorly, from a nasal bulge located 3/8 of the distance from the anterior orbital rim to the tip of the snout. The gular crest is composed of a continuous series of 24 low cones between the mentum and the angle of the jaw, and continues posteriorly as an even lower series of enlarged midline belly tubercles to the vent. The skin on the sides of the throat are incised by shallow grooves (6 on the left and 5 on the right).

The dorsal crest begins at the nape with 3 isolated small cones and is then followed by somewhat triangular laterally flattened tubercles that enlarge successively in groups of 2 to 3 along the dorsal ridge. The crest fades completely by the sacrum and then continues as a low series of angulated tubercles to again fade by the mid tail. Background scalation heterogeneous but not particularly coarse. A single row of slightly enlarged tubercles extends from the shoulder region over the upper third of the flank towards the pelvis. Belly covered with finer almost homogeneous flattened tubercles. The skin of the circular eyeball is covered in roughly homogeneous granules with a few slightly enlarged rounded tubercles seen scattered near the eye opening. The hemipenes are not extruded.

Dimensions: Snout/vent length 67 mm, Tail length 63 mm, Casque tip/snout 21 mm, Casque tip/commissure 13 mm, Commisure/snout 14 mm, Rostral process 3 mm.

Notes: The female of this species is currently undescribed.

Taxonomic affinities: *Ch.* (*Trioceros*) *conirostratum* is closely allied to the other chameleons of the "*Ch. bitaeniatus* group" (Rand 1963) as evidenced by the overall similarity to *Ch.* (*T.*) *bitaeniatus* Fischer, 1884 in body proportion and the shape and structure of its head and body crests. The unusual structure of its rostral process does not exclude it from the subgenus *Trioceros* where annulated horns are regarded as a synapomorphous character. The structure of its rostral projection does not strictly qualify as a horn and its position and orientation in the living chameleon awaits clarification. Other species of chameleon that are known to occur in the Imatong Mountains include *Ch.* (*Trioceros*) *bitaeniatus, Ch.* (*T.*) *kinetensis* Schmidt, 1943 and *Ch.* (*T.*) *ellioti* Günther, 1895 (Böhme & Klaver 1980). None of these species possess horns or rostral projections. *Ch.* (*Trioceros*) *marsabitensis* Tilbury, 1991 from the Marsabit volcano to the south east of the Imatongs, possesses a short single annulated rostral horn, and *Ch.* (*Trioceros*) *hoehnelii* Steindachner, 1891 differs in that its rostral projection is more of a clump of tubercles than a horn.

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Zusammenfassung

Es werden zwei neue Arten gehörnter Chamäleons aus isolierten Bergwäldern Ostafrikas beschrieben. Bei einer Art besitzt das Männchen einen markanten rostralen Zapfen, der keinem der von Chamäleons bekannten Anhänge ähnlich ist. Die andere Art zeichnet sich durch paarige geringelte Rostralhörner aus, ein Merkmal, welches bisher als charakteristisch für eine Gruppe westafrikanischer Chamäleons angesehen wurde.

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The community of rock-dwelling cichlids in Lake Victoria

Ole Seehausen & Niels Bouton

Abstract. New data from southern Lake Victoria show that a large group of probably more than 200 species of stenotopic rock-dwelling cichlids remained unrecognized until recently, thus disproving prior assumptions about the eurytopic character of Lake Victoria cichlids. We discuss the ecology of rock-dwelling cichlids in Lake Victoria based on the community at an isolated rocky island in the Speke Gulf. With emphasis on micro-distribution and feeding ecology we present data on the faunistic and ecological composition of a typical community. Communities are rich in species and ecologically complex. This may make them particularly vulnerable to changes in the environment.

Key words. Cichlidae, Lake Victoria, community ecology.

Introduction

Species rich groups of stenotopic rock-dwelling cichlids made the cichlid species flocks of Lakes Malawi and Tanganyika world famous among fish ecologists, evolutionary biologists and aquarists (e.g. Fryer & Iles 1972, Lowe McConnell 1993). It is still widely believed that Lake Victoria cichlids are much less stenotopic and the coexistence of several hundred apparently eurytopic species was considered a violation of the competitive exclusion principle (Greenwood 1981). Though the existence of rock-dwelling cichlids in Lake Victoria was known (van Oijen et al. 1981), it was believed that there are only a handful of such stenotopic species. New research in southern Lake Victoria shows that a huge group of probably more than 200 species remained basically unrecognized. In many respects closely resembling the Mbuna of Lake Malawi, they prove much of the prior assumptions about the eurytopic character of Lake Victoria cichlids wrong. Most of them are restricted to rocky substrate, have a limited distribution within the lake and geographic variation is well developed. Unfortunately their communities are under severe pressure due to large scale changes in the environment. Several rock-restricted species have already disappeared (Witte et al. 1992) and, unlike in open waters, Nile perch predation is probably not the direct cause. An understanding of the complex ecological structure of the communities is a first step towards an understanding of these developments. We give here an introduction to the community ecology of rock-dwelling cichlids in Lake Victoria on the example of the community at an isolated rocky island in the Speke Gulf. We present data on the faunistic and ecological composition of a typical community with emphasis on micro-distribution and feeding ecology. We show the ecological complexity of the community and its species richness, qualities which may make it particularly vulnerable to alterations in the environment.

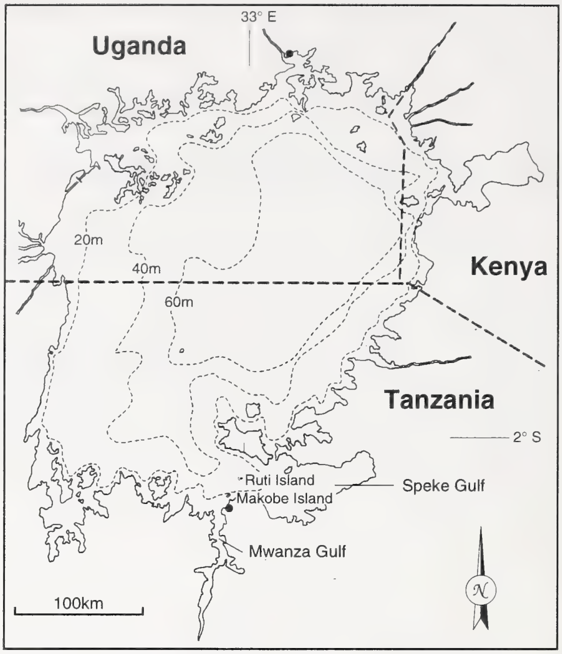

Fig. 1: Lake Victoria and the location of Makobe and Ruti Islands.

Materials and methods

Over a period of two and a half years (from January 1990 through July 1991, March to May 1992, September through December 1993 and February to April 1995) cichlids were sampled at the 0.075 km^2 (75 000 m^2) small rocky Makobe Island which lies 5 km offshore in the Speke Gulf entrance (Fig. 1). Makobe Island is an example of gently sloping islands with small to medium sized rock boulders and moderate geographical isolation. Sampling was done from the surface down to 6 m depth with gillnets of mesh sizes between 1 and 2 inches and by angling in rock pools and rocky crevices. The total sampling effort consisted of over 48 000 m^2 net hours and over 300 hours angling. Additionally underwater censuses were done by snorkeling. Relative abundances were determined with all three techniques. Microhabitat distribution of the species was scored by restricting samples to areas of one to a few square meters of rather uniform depth, exposure and rock cover.

Stomach contents of some individuals of each species were analyzed individually to identify food organisms. The contents of 40 individuals per species (each 10 from four seasons) were then centrifuged and quantified. It is necessary to study not only diet composition and spatial distribution but also how the food is obtained. We performed feeding experiments in the laboratory with the very species whose diet was analyzed. We studied the behaviour of fish feeding in experimental aquaria on *Aufwuchs* (algae and associated fauna) covered rocks from their natural habitat. After collection from the lake the fish were kept in aquaria without food for 40—48 hours and were then offered *Aufwuchs*-covered stones from the lake. Feeding behaviour was scored over a period of 30 minutes with two or three individuals per

experiment. Experiments were done for 9 to 15 individuals per species. To get a broader impression of the feeding repertoires that rock frequenting Lake Victoria haplochromines possess, the feeding behaviour of a few individuals of some less abundant species was studied as well. We calculated diet-overlap and behaviour overlap as the sum of the overlap per food item or feeding technique respectively.

With three exceptions (*Neochromis nigricans, "H." nyererei, Paralabidochromis chilotes*) the species used for this study are not formally described. Preliminary diagnoses and colour photographs were published recently (Seehausen 1996). A number of papers on their ecology, eco-morphology and taxonomy have been published (Seehausen & Bouton 1997; Bouton, Seehausen & van Alphen in press; Seehausen, Bouton, Zwennes & Lippitsch in prep.). In the meantime we use cheironyms for the undescribed species. Species recognition criteria used are those outlined by Seehausen (1996).

With regard to the generic taxonomy of Lake Victoria cichlids considerable heterogeneity is prevalent in recent publications with some authors following Greenwood's last general revision of 1980, others not. Though some of Greenwood's genera, we believe, need to be redefined, we could assign many of the new species. For those that we could not assign, we use the old generic name "*Haplochromis*" in quotation marks.

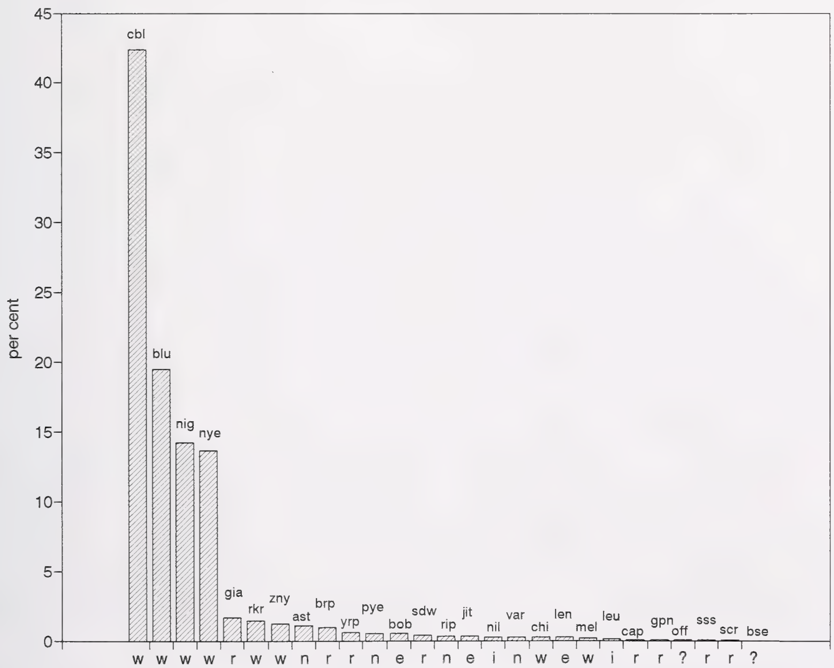

Fig. 2: Species abundance distribution at Makobe Island. Means of four sampling periods (n = 5919 fishes): abbreviations as in table 1. n = widely distributed, non-rock-restricted species, w = widely distributed rock-restricted species, r = regional rock-restricted species, e = local endemics, i = introduced species, non-rock-restricted.

Table 1: List of cichlid species occurring at Makobe Island/Speke Gulf. ++++ widely distributed, non-rock-restricted spp., +++ widely distributed rock-restricted spp., ++ regional rock-restricted spp., + local endemics, x introduced species, non-rock-restricted.

Algae scrapers	
Haplochromis "purple yellow"	++++
Neochromis nigricans (NIG)	+++
Neochromis "giant scraper" (GIA)	++
Neochromis "blue scraper" (BLU)	+++
Xystichromis "carp" (CAP)	++
Paralabidochromis "short snout scraper" (SSS)	++
Neochromis "large eye nigricans" (LEN)	+
Xystichromis "jitu" (JIT)	+
Haplochromis "blue obliquidens" (BOB)	+
Algae scrapers / Detritus eaters	
Oreochromis variabilis (VAR)	++++
Xystichromis "copper black" (CBL)	+++
Oreochromis niloticus (NIL)	x
Oreochromis leucostictus (LEU)	x
Animal *Aufwuchs* eaters	
Psammochromis riponianus (RIP)	++++
Paralabidochromis "rockkribensis" (RKR)	+++
Paralabidochromis chilotes (CHI)	+++
"*H.*" "zebra nyererei" (ZNY)	+++
Paralabidochromis "blue rockpicker" (BRP)	++
Paralabidochromis "yellow pseudorockpicker" (YRP)	++
"*H.*" "yellow chin pseudonigricans" (GPN)	++
"*H.*" "pink anal" (SDW)	++
Plankton eaters	
"*H.*" *nyererei* (NYE)	+++
Mollusc eaters	
Astatoreochromis alluaudi (AST)	++++
"*H.*" "striped crusher" (SCR)	++
Paedophages	
Lipochromis cf. *melanopterus* (MEL)	+++
food unknown	
"*H.*" "offshore" (OFF)	?
"*H.*" "blue secret" (BSE)	?

Results

I. Faunal composition and abundance distribution

The community at Makobe Island is composed of at least twenty-seven cichlid species (table 1). They can be assigned to five groups of different gross distribution patterns: 15 % are species widely distributed in Lake Victoria and not restricted to rocky substrates. All others are restricted to rocky substrates though they may occur in the immediate vicinity of rocks above other substrata. 30 % are species widely distributed at rocky shores and islands, 30 % are species with regionally restricted distribution (i. e. western Speke Gulf species), 11 % are endemics of Makobe Island and 7 % are introduced species (*Oreochromis niloticus* and *O. leucostictus*). The distribution of two species is not known. Figure 2 gives the mean abundance distribution at Makobe Island obtained over four sampling periods (n = 5919 fishes) and relates relative abundances to the distribution pattern groups. It shows that most of the numerically dominant species are species with a wide distribution, while most regional and all local endemics occur in low densities. This pattern was rather stable over the sampling years. Very similar results were obtained at another island in the Speke Gulf, Ruti Island, which is a steeply sloping island with very large compact rock boulders. This indicates (and is confirmed by samples from many other places), that the species that numerically dominate at one place do so at most of the places where they occur.

II. Spatial community structure

Figure 3 shows the relative abundance of the four dominant and some other species in different microhabitats and depths. Figure 3a is based on angling and net samples, Figure 3b on underwater censuses. The species show significantly different vertical distributions (Fisher's exact probability test $p < 0.05$). Figure 4 gives two examples of horizontal species distribution patterns indicating that horizontal patterns are species specific as well. They reflect not only differences in microhabitat requirements but likely also different degrees of microhabitat stenotopy. *Xystichromis* "copper black" lives in a wide range of microhabitats from the surf zone to several meters depth, between rocks of all boulder sizes and at strongly surf exposed places as well as in protected embayments and under floating vegetation. This relatively wide ecological range enables the species to inhabit a large part of the available rocky habitat. Its distribution is not indicated in Figure 4 because it was found in each of the 10 x 10 m squares. Widely distributed in the offshore waters but largely absent from the inshore areas is "*H.*" *nyererei* (Fig. 4) while "*H.*" "zebra nyererei" is restricted to crevices between medium sized rocks along the shore and at rocky islets. *Haplochromis* "blue obliquidens" finally, as an extreme example, occurs exclusively in less than 2 m depth on the surface of gently sloping rock fields in surf protected embayments (Fig. 4). It appears that more or less specific demands restrict the distribution of species to differently sized fractions of the potentially available rocky habitat. However, it is not yet understood whether interspecific competition plays a role in delimiting the microhabitat distribution of some species.

III. Trophic community structure

Figure 5a shows the result of laboratory feeding experiments for the four most abundant species plus two rare species. Feeding techniques are defined elsewhere (Seehausen, Bouton, van Alphen, Witte submitted). The composition of feeding ethograms of the six species differs quantitatively significantly different (U-test $p<0.05$). Coefficients for overlap are given in table 2. The species can be assigned to three major feeding behaviour groups according to the predominantly employed feeding technique: pull-scrapers, pickers (both benthic foragers) and snappers (pelagic foragers). Since behavioural differences were recorded in the absence of interspecific competition they are to be considered autecological.

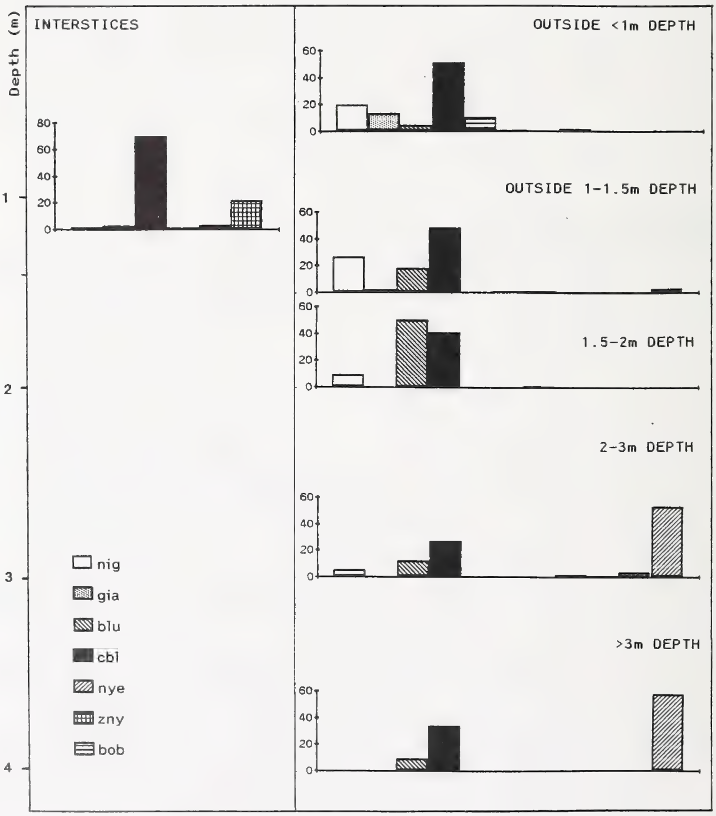

Fig. 3a: Examples of vertical habitat segregation. Relative densities of rock-dwelling haplochromine species in different microhabitats at Makobe Island: Interstices between rocks in shallow water and different depth ranges outside of the interstices. Based on net and angling samples. Abbreviations as in table 1.

Figure 5b shows the result of stomach content analyses for the same species. The four abundant species disperse over three major trophic groups that correspond to the three feeding behaviour groups: scrapers of filamentous algae, loose algae/ animal *Aufwuchs* eaters, and plankton eaters. A fourth trophic group, not reflected in the feeding behaviour due to absence of its specific prey, are snail eaters. However, their specific feeding technique, pharyngeal crushing, is well known (Greenwood 1974). The interspecific differences in diet are significant (U test $p<0.05$) with the exception of that between the two algae scrapers *N. nigricans* and *N.* "blue scraper". Coefficients for diet-overlap are given in table 2.

Several other trophic groups are rather consistent members of rock cichlid communities: pedophages, piscivores and crab eaters. These larger predators probably always occurred in lower densities than *Aufwuchs* and plankton feeders, however, after the Nile perch upsurge they completely disappeared at many places. At Makobe Island we frequently caught one pedophagous species (Table 1).

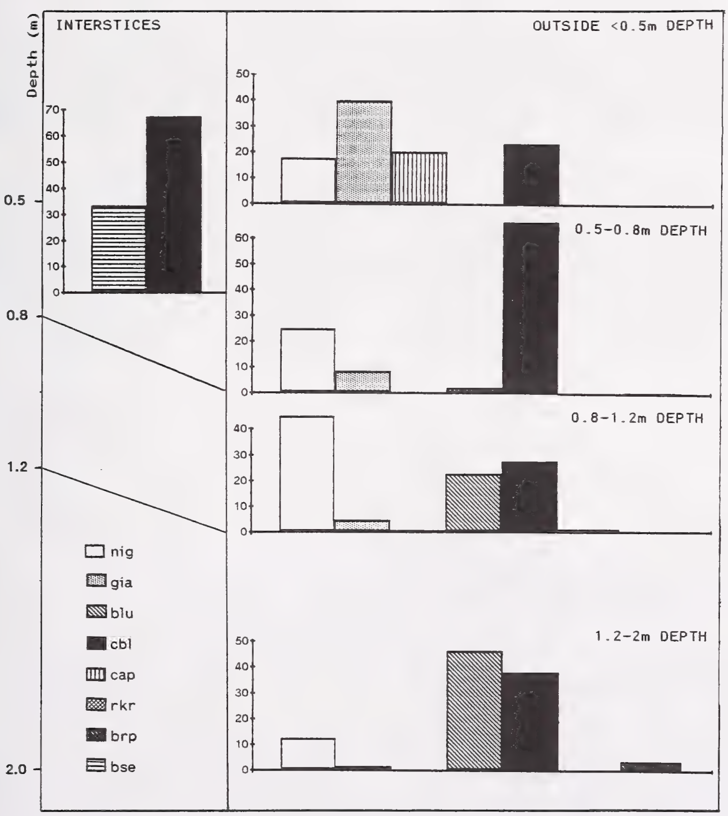

Fig. 3b: Same as 3a but based on underwater censuses.

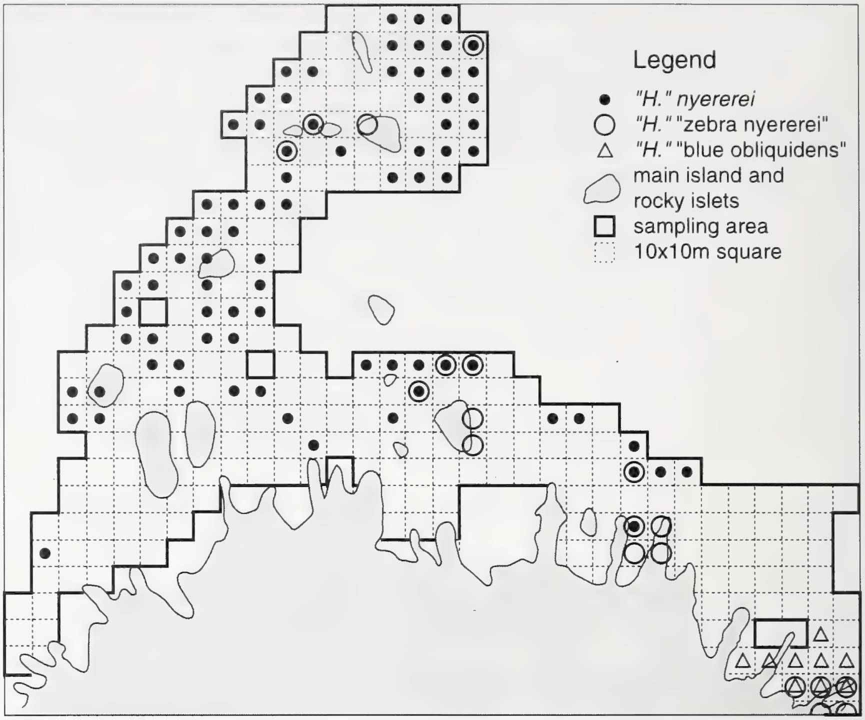

Fig. 4: Examples of horizontal habitat segregation among haplochromine species at the west shore of Makobe Island. Among a pair of sibling species "*H*." "zebra nyererei" lives more inshore and in the immediate vicinity of rocky outcrops than "*H*." *nyererei*. Only the first one occurs frequently in crevices and rockpools within the island in several metres distance from the lake. *H.* "blue obliquidens" occurs only at small patches of suitable microhabitat.

Table 2: Coefficients of trophic niche overlap.

Diet						Feeding behaviour					
	NIG	BLU	CBL	ZNY	NYE		NIG	BLU	CBL	ZNY	NYE
BLU	.90					BLU	.85				
CBL	.59	.57				CBL	.47	.56			
ZNY	.29	.31	.31			ZNY	.36	.45	.88		
NYE	.12	.12	.12	.70		NYE	.44	.52	.61	.73	
AST	.00	.00	.00	.00	.00	AST	.22	.25	.49	.66	.39

Discussion

The studied community of rock-dwelling cichlids in Lake Victoria shows a rich ecological structure. It is characterized by few very abundant and many rare species. The abundant species are usually widely distributed and represent the three trophic groups that at many places allow the highest levels of population density: scrapers

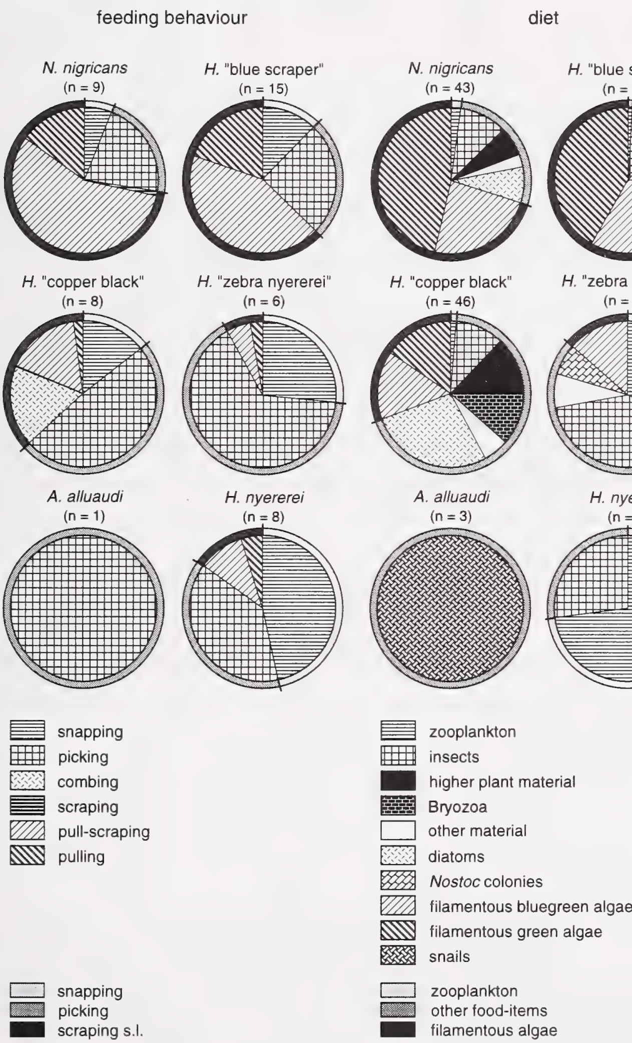

Fig. 5: Left two columns: feeding behaviour ethograms of the four numerically dominant and two other species at Makobe Island. Right two columns: Composition of the diet of the four numerically dominant and two other species at Makobe Island. In the outer circle several categories are lumped to form three principal feeding techniques and the three major food categories that reflect them.

of filamentous algae, loose algae/animal *Aufwuchs* eaters and planktivores. Most locally endemic species occur in low densities. This pattern may suggest that the key niches in the communities of rocky habitat islands were filled by a few species early during the formation of the present days lake and that the finer ecological community structure is largely a secondary phenomenon due to ecological differentiation and speciation that happened on regional scales. This is a hypothesis that calls for tests by interdisciplinary approaches.

The different species in the rock cichlid community can be well characterized ecologically. Each occupies only a particular portion of the total ecological niche available to rock-dwelling cichlids. The differences, however, are subtle and the ecological packing is very dense. Only the upper five meters are occupied by epilithic *Aufwuchs* scrapers but ten such species share this narrow depth zone. The peaks of their relative abundance are in different microhabitats and depths but those of neighbouring species are separated by no more than one to two meters. Among them are three of the four numerically dominant species. Trophic morphology of two of them (*N. nigricans, N.* "blue scraper") is so similar that it is difficult to identify preserved specimens that lost colouration. Yet they exhibit autecological differences in feeding behaviour which, together with subtle aut- or synecological differences in microhabitat distribution (and possibly synecological competition effects on feeding behaviour), result in significantly reduced diet overlap.

There is no evidence that the cichlid species assemblage of Makobe Island violates the competitive exclusion principle but the dense spatial packing of morphologically and ecologically very similar species is likely to make the community highly susceptable to changes in the environment. Tightening and relaxation of interspecific competition may under such circumstances be some immediate response to contraction and expansion of the habitat. Some fluctuation of habitat width is a natural seasonal phenomenon caused by water level fluctuations. However, recently more dramatic changes take place that lead to a more permanent alteration of the habitat: water transparencies are significantly decreasing since at least the late seventies, reducing the habitat width for algae feeders, and upwelling of anoxic waters at steep rocky cliffs affects the communities of planktivores and benthivores in deeper waters. It is possible that such processes add to the species loss in rocky areas that is caused by the impact of turbidity on colour vision and species-assortative mating (Seehausen, van Alphen & Witte 1997) but much more work is needed to understand this.

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New and little known *Nebria* (*Epinebriola*) from the eastern Nepal Himalayas (Coleoptera, Carabidae) *

V. G. Shilenkov

Abstract. Data on taxonomy and geographical distribution of some species of *Nebria*, subgenus *Epinebriola* Daniel, from eastern Nepal are given. Two species are described as new: *N. schawalleri* n. sp. and *N. tangjelaensis* n. sp.

Key words. Coleoptera, Carabidae, *Nebria*, taxonomy, new species, Nepal.

Introduction

The northeastern part of Nepal along the border to Sikkim in the east and to Tibet in the north was hitherto quite poorly investigated under entomological aspects because of difficult accessibility. I was able to study interesting material of Carabidae from that region between the Tamur and Arun river systems collected by J. Martens and W. Schawaller during their expeditions in Nepal in 1983 and 1988 (map see fig. 11).

The species of *Nebria* were collected in high altitudes up to 5000 m near snow cover and all belong to a single subgenus, *Epinebriola* Daniel. Representatives of that subgenus are restricted in distribution to the Hindukush and Himalayas mountain systems and are divided in some species groups. The eastern branch of this subgenus includes most derived species: *rasa* Andrewes and *schawalleri* n. sp., both possess a surplus setation on the pronotum, a bisetose penultimate labial palpomere and weakly impressed elytral striae dissappearing laterally. Without doubts these species are closely related to *orestias* Andrewes and cannot be separated from the subgenus *Epinebriola* inspite of the unique combination of the above mentioned features.

Other material of the genus *Nebria* from different Himalayan localities was treated earlier by Andrewes (1929, 1932, 1936) and Ledoux (1984, 1985). The descriptions and measurements in the present paper are standardized as in Shilenkov (1982).

Abbreviations and material depository: HW, head width; HL, head length; PW, pronotum width; PL, pronotum length; PBW, pronotum base width; EW, elytra width; EL, elytra length; ISU, Irkutsk State University (collection Shilenkov); SMNS, Staatliches Museum für Naturkunde Stuttgart; ZFMK, Museum Alexander Koenig Bonn.

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*) Results of the Himalaya Expeditions of J. Martens, No. 213. — For No. 212, see Entomol. Basiliensia 20, 1997. — J. M. sponsored by Deutscher Akademischer Austauschdienst and Deutsche Forschungsgemeinschaft.

Descriptions

Nebria (*Epinebriola*) *schawalleri* n. sp.

Holotype, female: Nepal, Taplejung distr., ascent to Tangje La NW Walungchung Gola, 4400–4600 m, alpine steppe, 23. V. 1988 leg. Martens & Schawaller (SMNS).

Description: Size large, standardized body length female 10.8 mm. Pitch-black, shiny, appendages red-brown, femora and antennal scape infuscated.

Head (fig. 1) relatively large and wide, with shallow transverse impression behind prominent eyes. Labrum with anterior margin evidently prominent, bearing 6 setae. Clypeus convex, slightly sinuated apically, frontoclypeal suture strong and deep, frontal furrows short and flat, vertex distinctly wrinkled. Surplus setation of head capsule: 2 and 3 supraorbital pores asymmetrically, additional clypeal pore unilaterally and one pore (? artifact) at the middle of the frons. Antennae slender, extending in female almost to the middle of elytra, antennal scape elongate, with 1 seta, second antennomere with 1 seta ventroapically, third antennomere with 6 setae apically. Median tooth of mentum 2.5 times as short as epilobes, sharply bidentate with V-shaped notch. Ligula with fingerlike process bearing 2 long setae apically. Penultimate labial palpomere bisetose, submentum with transverse row of 11 setae.

Pronotum (fig. 1) subcordate, basal sinuation of lateral margin moderately long and deep; basal angles short, acute, narrowly rounded apically, projected posteriorly; apical angles widely rounded, weakly prominent anteriorly; basal margin strongly bisinuate, with additional small notches just before basal angles; lateral explanation narrow, slightly broadened at middle; pronotum disc convex, with faint radial wrinkles and a pair of small pitlike impressions, basal foveae deep and narrow, basal and apical areas with sparse but rather strong punctuation, transverse and longitudinal impressions strong and deep, anterior transverse impression strongly sinuated basally and deeply impressed; basolateral seta present (at the left basal angle 2 setae), series of 5–6 midlateral setae sinuated in the apical half of pronotum. Proepisternum sparsely and weakly punctate; prosternal process elongate, rounded apically, unmargined.

Elytra moderately convex, subovoid, elongate, narrowed basally; humeral sinuation very shallow, subapical sinuation absent; basal margination straight, merged smoothly with lateral margination, humeral carina absent or very slightly developed; apical angles rather sharp, rounded apically; subapical carina evanescent; striae shallow, with traces of punctuation; obliterate at the margins of elytra, stria 8 invisible; scutellar stria long, scutellar seta present; intervals scarcely convex, third interval with 4–6 very small discal setae adjoining stria 3. Metepisterna 1.5 times as long as wide, sparsely and faintly punctate. Hind coxa with 2 (or 1 unilaterally) basal seta(e) and 1 apical seta. Hindwings vestigial, without traces of venation.

Third to fifth visible abdominal sterna each with 3 pairs of posterior paramedial setae and with rather deep oblique impression laterally; anal sternite of female with 6 setae on hind margin.

Legs long and slender, metatarsomere 4 with long ventrolateral lobe.

Microsculpture on head and pronotum isodiametric, consists of very small sculpticells; on elytra strongly reduced, consists of very small and transverse meshes.

Apical gonocoxite of female long and slender (fig. 9), bearing 3 lateral setae on inner margin.

Proportions: PW/HW = 1.29; PW/PBW = 1.48; EW/PW = 1.61; PW/PL = 1.36; EL/EW = 1.56.

Length 12.5 mm, width 4.7 mm.

Diagnosis: The form of the pronotum and the setation are unique and separate this species from all representatives of the subgenus *Epinebriola*.

Geographical distribution: Known only from the type locality in the eastern part of the Nepal Himalayas.

Derivatio nominis: With great pleasure I name this species in honour of my collegue Dr. Wolfgang Schawaller from the Staatliches Museum für Naturkunde in Stuttgart, who collected this species together with J. Martens and who provided me with this very interesting material.

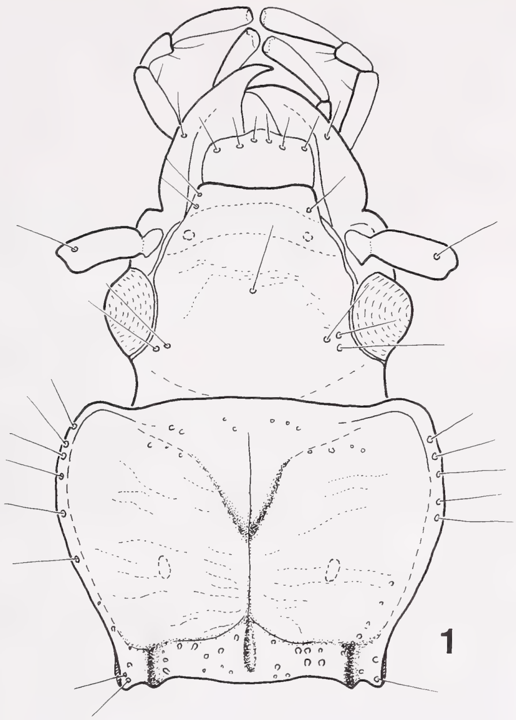


Fig. 1: *Nebria schawalleri* n. sp., head and pronotum, scale 1 mm.

Nebria (*Epinebriola*) *rasa* Andrewes, 1936

Material: Nepal, Sankhua Sabha distr., from Thudam to Gabri Khola, 4000–4250 m, dwarf *Rhododendron*, 27. V. 1988 leg. Martens & Schawaller, 4 males, 3 females. Nepal, Sankhua Sabha distr., Kangla Khola E Thudam, 4100–4200 m, dwarf *Rhododendron*, rock debris, 24.–25. V. 1988 leg. Martens & Schawaller, 10 males, 1 female (ISU, SMNS, ZFMK).

This species was described from Sikkim (Ratong Chu) on a single female collected in an elevation of 11 000 feet. The taxonomical status was unclear, Andrewes (1936) compared it with *barbata* Andrewes. The redescription is given below.

Size moderate, standardized body length male 9.42, female 10.2 mm.

Pitch-black, shiny, legs dark piceous with testaceous tarsi and tibiae (in some individuals tibia infuscated), antennae entirely red-brown, or antennal scape slightly infuscated.

Head with shallow transverse impression behind prominent eyes; labrum with anterior margin straight or faintly prominent, bearing 6 setae; apical margin of clypeus straight or scarcely concave; frontal furrows hardly discernible, vertex faintly wrinkled; only with 1 pair of supraorbital setae. Antennae long and slender, extending in female to the middle of elytra, in male longer; antennal scape almost straight, with faintly sinuated apical margin, slightly narrowed basally, bearing 1 seta, second antennomere with 1 or 2 seta(e), third antennomere

with 5—6 setae apically. Median tooth of mentum 2.0 times as short as epilobes, bidentate with shallower notch than in the previous species, denticules apically obtuse. Ligula with fingerlike process bearing 2 long setae apically. Penultimate labial palpomere bisetose, submentum with transverse row of 10—12 setae, interrupted medially.

Pronotum (fig. 2) convex, subcordate, basal sinuation of lateral margin very short and shallow, situated just before very small and acute basal angles, projected posteriorlaterally; apical angles widely rounded, weakly prominent anteriorly; basal margin bisinuate; lateral explanation narrow, slightly broadened basally; transverse and longitudinal impressions distinct but not so strong and deep as in the previous species; punctuation faint and sparse; basolateral seta present, series of 3—4 midlateral setae situated in the apical half of pronotum. Proepisternum sparsely and weakly punctate; prosternal process elongate, rounded apically, unmargined.

Elytra in shape as in the previous species, but apical angles more rounded; striae and intervals with the same structure, scutellar seta absent, rarely present unilaterally; discal setae very small, 4—5 setae in third interval adjoining stria 3, 2—4 setae in fifth and 0—4 in seventh interval (in the original description only 6 setae in the third interval are mentioned). Metepisterna 1.5 times as long as wide, smooth. Hind coxae with 2 basal and 1 apical setae. Hindwings verstigial, without traces of venation, shorter than in the previous species.

Third to fifth visible abdominal sterna each with 2 or 3 pairs of posterior paramedial setae and with rather deep oblique impression laterally; anal sternite of male with 5—6, of female with 6 setae on hind margin.

Legs as in the previous species, in male 3 first tarsomeres of protibia weakly expanded and with pad of adhesive setae ventrally.

Microsculpture faintly impressed, on head isodiametric, consists of very small sculpticells, on pronotal disc slightly transverse, almost isodiametric, on elytra consists of very small transverse meshes.

Basal part of median lobe (fig. 6) wide, with strongly prominent triangle basal lobes, apex of median lobe long and slender. Apical gonocoxite of female shorter than in the previous species (fig. 8).

Proportions: PW/HW = 1.21—1.23; PW/PBW = 1.46—1.54; EW/PW = 1.60—1.70; PW/PL = 1.17—1.34; EL/EW = 1.52—1.64.

Length 11.0—11.9 mm, width 4.2—4.5 mm.

Diagnosis: Differs from *schawalleri* n. sp. by the form of the pronotum, by the setation on head and pronotum, by the structure of the female apical gonocoxite and by smaller size.

Geographical distribution: Eastern parts of the Himalayas in Nepal and Sikkim.

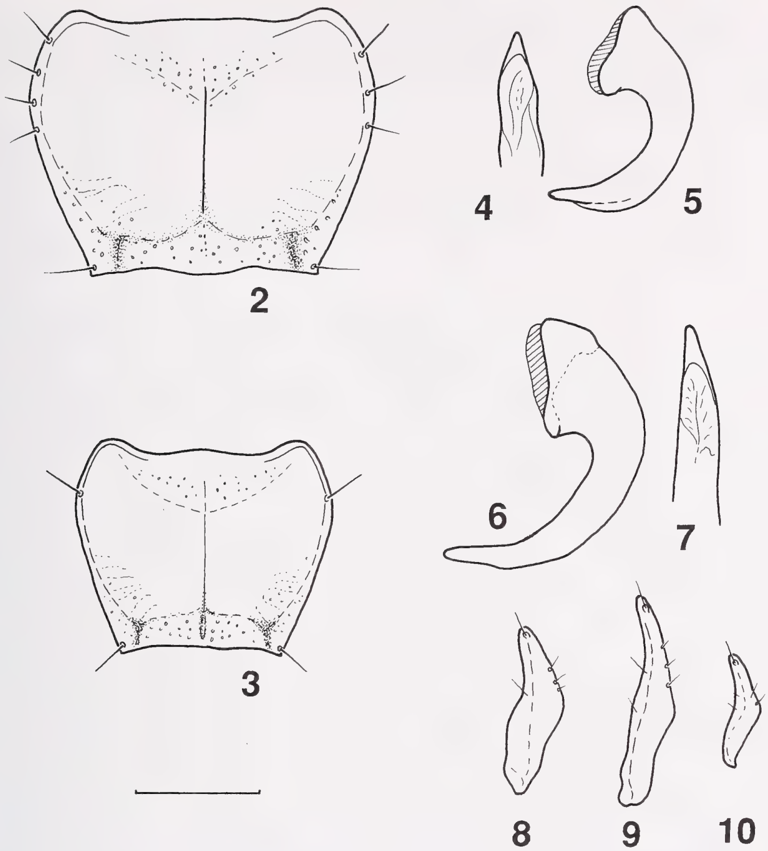
Nebria (*Epinebriola*) *tangjelaensis* n. sp.

Holotype, male: Nepal, Taplejung distr., ascent to Tangje La NW Walungchung Gola, 4800—5000 m, alpine steppe, 23. V. 1988 leg. Martens & Schawaller (SMNS).

Paratypes: With the same labels, 5 males, 1 female (ISU, SMNS, ZFMK). Nepal, Taplejung distr., ascent to Tangje La NW Walungchung Gola, 4400-4600 m, alpine steppe, 23. V. 1988 leg. Martens & Schawaller, 1 male (SMNS).

Description: Size rather small, standardized body length male 7.74, female 8.10 mm. Dark piceous, shiny, mouthparts, antennae and legs red-brown, rarely femora infuscated.

Head with shallow transverse impression behind prominent eyes; labrum with anterior margin straight; apical margin of clypeus straight or scarcely concave; frontal furrows hardly discernible or evanescent, vertex smooth; only 1 pair of supraorbital setae. Antennae long and slender, almost extending to the middle of elytra, antennal scape almost straight, with faintly sinuated apical margin, moderately narrowed basally, bearing 1 seta, second antennomere with 1 seta lateroapically, third antennomere with 5—6 setae apically. Ligula with fingerlike process bearing 2 long setae apically. Penultimate labial palpomere trisetose, submentum with transverse row of 11—12 setae, interrupted medially.



Figs 2—10: 2, *Nebria rasa* Andrewes, pronotum; 3, *Nebria tangjelaensis* n. sp., pronotum, scale 1 mm; 4, *Nebria tangjelaensis* n. sp., median lobe from dorsal; 5, *Nebria tangjelaensis* n. sp., median lobe from left lateral; 6, *Nebria rasa*, median lobe from left lateral; 7, *Nebria rasa*, median lobe from dorsal; 8, *Nebria rasa*, left apical gonocoxite from ventral; 9, *Nebria schawalleri* n. sp., left apical gonocoxite from ventral; 10, *Nebria tangjelaensis* n. sp., left apical gonocoxite from ventral.

Pronotum (fig. 3) moderately convex, subcordate, uniformly narrowed basally, lateral margins in basal half almost straight, without basal sinuation, or with long and very shallow basal sinuation, basal angles obtuse with small and apical denticules, projected posterior-laterally; apical angles widely rounded, weakly prominent anteriorly; basal margin moderately bisinuate; lateral explanation very narrow, sligthly broadened basally; transverse impressions rather strong, longitudinal impression shallow but distinct, punctuation faint and sparse; basolateral seta present, midlateral seta situated in the apical quarter of pronotum. Proepisternum almost smooth, with sparse and weak punctures; prosternal process elongate, rounded apically, unmargined.

Elytra moderately convex, in some individuals longitudinally depressed along suture, subovoid, elongate, faintly narrowed basally; humeral sinuation long and very shallow, subapical sinuation almost evanescent; basal margination straight, merged smoothly with lateral

margination, humeral carina absent or very slightly developed; apical angles narrowly rounded; subapical carina short and hardly flattened; striae moderately impressed, distinctly punctate on disc, obliterate at margins and apex of elytra; scutellar stria long, scutellar seta absent; intervals on disc rather convex, flattened laterally and apically; discal setae absent.

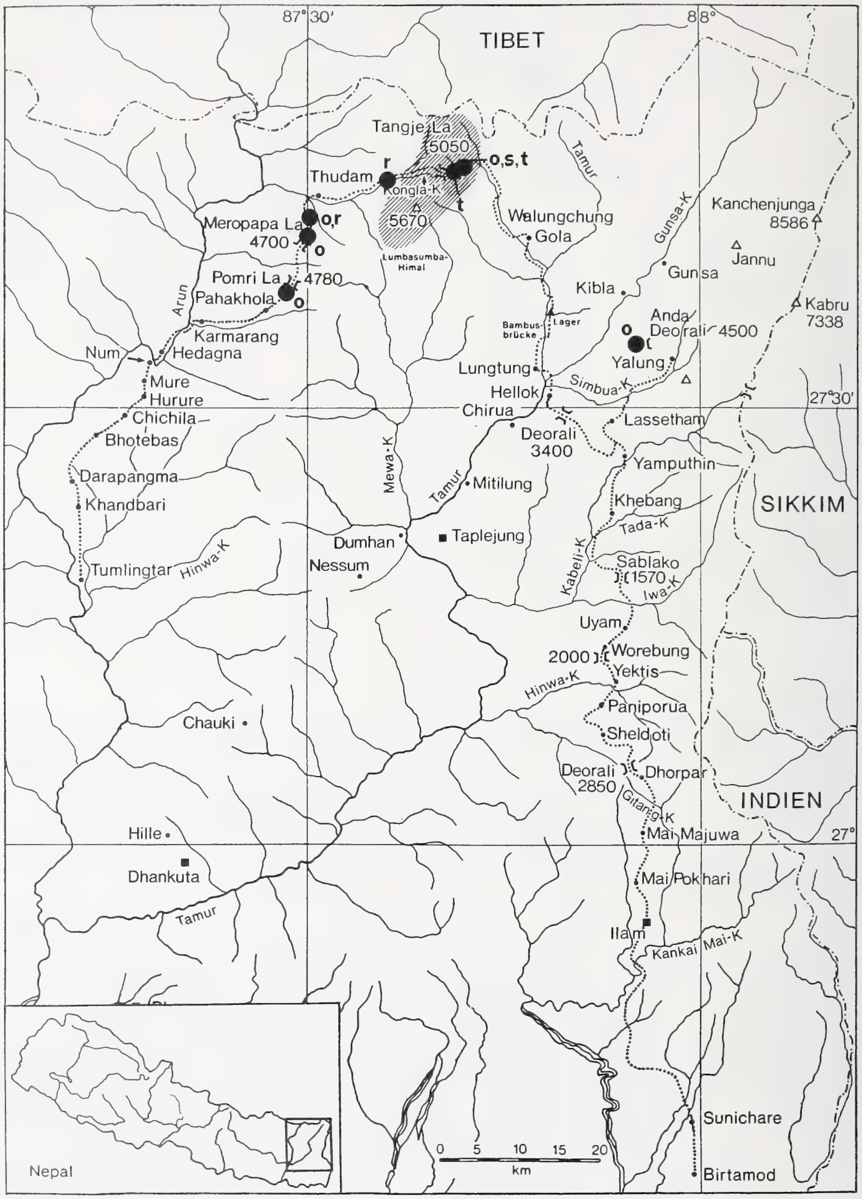


Fig. 11: Map of localities in eastern Nepal. o. *orestias*, r. *rasa*, s. *schawalleri* n. sp., t. *tangjelaensis* n. sp.

Metepisterna 1.5 times as long as wide, longitudinally depressed, almost smooth. Hind coxae with 1 basal seta and 1 apical seta, their apical part evidently punctate. Hindwings vestigial, without traces of venation.

Third to fifth visible abdominal sterna each with 3 or 4 pairs of posterior paramedial setae and with rather deep oblique impression laterally; anal sternite of male with 4, of female with 5—6 setae on hind margin.

Legs long and slender, in male 3 first tarsomeres of protibia weakly expanded and with pad of adhesive setae ventrally, metatarsomere 4 with rather long ventrolateral lobe.

Microsculpture faintly impressed, on head isodiametric, consists of very small sculpticells, on pronotal disc slightly transverse, almost isodiametric, on elytra consists of very small transverse meshes.

Median lobe (fig. 5) strongly curved, rather stout, with apex short and acute. Apical gonocoxite of female smaller than in the previous species (fig. 10).

Proportions: PW/HW = 1.10—1.21; PW/PBW = 1.52—1.59; EW/PW = 1.57—1.72; PW/PL = 1.19—1.35; EL/EW = 1.56—1.65.

Length 8.9—9.2 mm, width 3.3—3.4 mm.

Diagnosis: Closely related to *orestias* Andrewes, 1932, but smaller, body paler, pronotum different, especially in the form of basal angles, median lobe of male smaller with shorter apex.

Geographical distribution: Known only from the type locality in the eastern Nepal Himalayas.

Derivatio nominis: This species is named after the pass Tangje La, the type locality.

Nebria (*Epinebriola*) *orestias* Andrewes, 1932

Material: Nepal, Taplejung distr., ascent to Tangje La NW Walungchung Gola, 4400—4600 m, alpine steppe, 23. V. 1988 leg. Martens & Schawaller, 11 specimens. Nepal, Taplejung distr., Anda Deorali between Simbua and Gunsa Khola, 4250—4500 m, alpine zone, 9. IX. 1983 leg. Martens & Daams, 3 specimens. Nepal, Sankhua Sabha distr., from Thudam to Gabri Khola, 4000—4250 m, dwarf *Rhododendron*, 27. V. 1988 leg. Martens & Schawaller, 2 specimens. Nepal, Sankhua Sabha distr., ascent to Meropapa La from Gabri Khola S Thudam, 4300—4600 m, meadows with dwarf *Rhododendron*, 26. V. 1988 leg. Martens & Schawaller, 8 specimens. Nepal, Sankhua Sabha distr., descent from Pomri La, S slope, 4550—4450 m, under snow covered stones, 29. V. 1988 leg. Martens & Schawaller, 1 specimen (ISU, SMNS, ZFMK).

The species was described by Andrewes (1932) from "Sikkim-Tibet, Jelep Pass". The taxonomical status of this species was unclear. Recently, Ledoux (1985) included the species in his subgenus *Himalayonebria*, briefly characterized in the determination key and by figures of the pronotum and male genitalia.

Geographical distribution: In the eastern Himalayas in Nepal and Sikkim and probably in the adjacent territory of Tibet.

Acknowledgements

I thank Dr. W. Schawaller for the loan of the specimens, for his support and hospitality during my visit in the Staatliches Museum für Naturkunde in Stuttgart and for the help in publishing this paper. Thanks are due also to G. Ledoux for sending types and other important material from the Himalayas.

Zusammenfassung

Daten zur Taxonomie und geografischen Verbreitung einiger *Nebria*-Arten, Untergattung *Epinebriola* Daniel, aus Ost-Nepal werden mitgeteilt. Zwei Arten werden neu beschrieben: *N. schawalleri* n. sp. und *N. tangjelaensis* n. sp.

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Die Sandlaufkäfer (Coleoptera: Cicindelidae) des Comoé-Nationalparks, Elfenbeinküste: Faunistik, Zoogeographie und Ökologie

Jakob Fahr

Abstract. The tiger beetles (Coleoptera: Cicindelidae) of the Comoé National Park, Ivory Coast: faunistics, zoogeography and ecology. 23 tiger beetle species are reported from the study area covering about 10 km^2. *Cylindera lutaria*, *Habrodera nilotica*, *Lophyridia fimbriata* and *Myriochile flavidens* are recorded for the first time from the Ivory Coast. *Euryarthron planatoflavum* is recorded for the first time from Upper Volta. One new species (*Dromicoida elegantia*) was discovered (Werner 1995). The study site supports a species-rich tiger beetle fauna, which is caused by a highly diverse habitat mosaic. Only very few species are restricted to the Ivory Coast and adjacent countries, many reach as far as Central or East Africa. Possible explanations for this pattern are discussed. Tiger beetles are members of a carnivorous arthropod guild which hunt at very high temperatures. Because of the extreme environmental conditions there are very few competitors. Moreover, tiger beetles seem to compete mostly with sympatric congeners because of very similar life histories. The specific habitat preferences of each species are analysed and the Hutchinsonian ratios of sympatric tiger beetles with respect to mandible length compared. It is shown that species which occur in the same habitat and exhibit a similar behaviour generally follow the predicted character divergence. In contrast, sympatric species with different micro-habitat preferences show only minor divergence. These results are discussed as a response to reduce competition.

Key words. Coleoptera, Cicindelidae, tiger beetles, West Africa, Ivory Coast, zoogeography, distribution, ecology.

Einleitung

Sandlaufkäfer sind innerhalb der Caraboidea eine der taxonomisch am besten untersuchten Gruppen. Weltweit sind über 2000 Arten beschrieben. Da die Imagines von Cicindeliden im natürlichen Lebensraum relativ gut zu erfassen und zu beobachten sind, eignen sie sich besonders gut für eine Vielzahl von Fragestellungen. In den letzten Jahren sind insbesondere Aspekte der interspezifischen Konkurrenz und Mikrohabitatswahl in den Vordergrund gerückt (Pearson & Mury 1979, Pearson 1980, Pearson & Knisley 1985, Ganeshaiah & Belavadi 1986, Schultz & Hadley 1987, Pearson & Juliano 1991). Dadurch können Aussagen über Standortkonstanz und Nischengröße getroffen werden. In Gebieten, die eine artenreiche Cicindelidenfauna beherbergen, sind zudem charakteristische Vergesellschaftungsmuster festzustellen. Es stellt sich vor allem für tropische Breiten die Frage, ob diese Artenkombinationen durch exogene Faktoren determiniert werden. Dazu ist eine genaue Analyse der spezifischen Habitatsansprüche sowie der Phänologie, Larvalbiologie und Verbreitungsmuster notwendig. Sollten diese Vergesellschaftungen einen stabilen Zustand für einen gegebenen Zeitraum darstellen, dann müßten auf Grund des Konkurrenzaus-

schlußprinzipes die syntopen Arten eine Nischendifferenzierung aufweisen, die sich als morphologische Differenzierung manifestieren kann.

Die meisten Sandlaufkäferarten sind tagaktive, räuberische Caraboiden, die optisch orientiert ihre Beute jagen und spärlich bewachsenen Untergrund mit Rohbodencharakter bevorzugen (Ausnahmen bilden die in der Regel nachtaktiven Manticorini und die arborealen Vertreter der Collyrinae). Weiterhin zeichnet sich die Familie durch eine hohe morphologische Ähnlichkeit aus. Cicindeliden sind bei sehr hohen Temperaturen aktiv und nur wenige carnivore Arthropoden kommen unter diesen Bedingungen als mögliche Konkurrenten in Frage (z. B. Spinnen und Ameisen). Im Freiland und in Laborexperimenten wurde nachgewiesen, daß Nahrung als limitierender Faktor sowohl für Imagines als auch für Larven eine entscheidende Rolle spielt (Pearson & Knisley 1985, Knisley, 1987). Eine mögliche Form der Konkurrenzverminderung bei koexistierenden Arten kann durch eine Merkmalsverschiebung (character divergence bzw. -displacement) erreicht werden, indem ein Merkmal, das zur effektiven Nutzung einer limitierten Ressource entscheidend beiträgt, bei den syntop vorkommenden Arten unterschiedlich ausgeprägt ist (Hutchinson 1959, Schoener 1965). Hutchinson (1959) ermittelte einen empirischen Wert von 1.28 für die mittlere minimale Differenz von Mundwerkzeugen innerhalb syntoper Arten einer Gilde.

Bei Sandlaufkäfern ist die Mandibellänge mit der Körpergröße des bevorzugten Beutespektrums positiv korreliert (Pearson & Mury 1979, Pearson & Stemberger 1980). Für bestimmte Habitate wurde gezeigt, daß syntop vorkommende Cicindelidenarten in Bezug auf Mandibellänge der Hutchinson-ratio folgen (Pearson & Mury 1979, Pearson 1980, Pearson & Juliano 1991). Es muß allerdings beachtet werden, daß eine Nischendifferenzierung durch eine Vielzahl von verschiedenen Variablen ermöglicht werden kann. Es können sich die einzelnen Arten z. B. in ihrer Larvalbiologie, bevorzugtem Substrat, Bodenfeuchte, Temperatur, Verhalten gegenüber Prädatoren usw. so unterscheiden, daß Koexistenz ermöglicht wird (Dreisig 1980, 1981, Guppy et al. 1983, Ganeshaiah & Belavadi 1986, Knisley 1987, Mury Meyer 1987, Schultz & Hadley 1987). Ganeshaiah & Belavadi (1986) untersuchten die Mikrohabitatswahl von vier sympatrischen Sandlaufkäferarten an einem Flußufer in Indien und wiesen nach, daß sich ihre Mikrohabitate nicht überlappten und daher auch keine direkte Nahrungskonkurrenz vorhanden war, daß aber Parameter wie vorherrschende Beutegröße, Bodenfeuchte und Deckungsgrad der Vegetation zuverlässig die Verteilung der einzelnen Arten vorhersagten. Daher ist es notwendig, alle Möglichkeiten der Nischendifferenzierung in Betracht zu ziehen und gegeneinander abzuwägen.

In der vorliegenden Arbeit war es auf Grund des beschränkten Untersuchungszeitraumes nicht möglich, viele der biotischen und abiotischen Parameter ausreichend zu erfassen. Daher stützt sich die im nachhinein durchgeführte Analyse der Mandibellängen auf Annahmen, die durch die Feldbeobachtungen der einzelnen Arten gewonnen wurden.

Untersuchungsgebiet

Die Untersuchung wurde vom 19. 3.—26. 4. 1993 im Comoé-Nationalpark, Elfenbeinküste, Westafrika, durchgeführt (Abb. 1). Der Nationalpark liegt im Nordosten der Elfenbeinküste

und erstreckt sich über eine Fläche von 11 500 km² (9°6'N—8°5'N; 3°1'W—4°4'W). Die ausgeprägte Trockenzeit reicht von November bis März, allerdings variieren Niederschlagsverteilung und -menge oftmals erheblich. Das eigentliche Untersuchungsgebiet lag in einem Umkreis von ca. 5 km um das „Camp an der Lola“, das vom Zoologischen Lehrstuhl III für Tierökologie und Tropenbiologie der Universität Würzburg unterhalten wird. Das Camp liegt im Südosten (Abb. 2) des Nationalparks und damit im nördlichsten Bereich der Guinea-Zone.

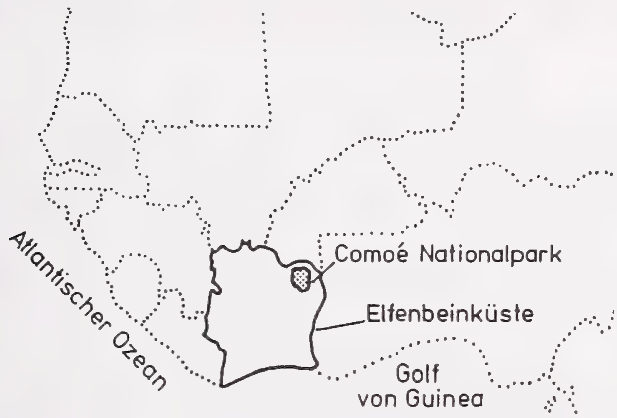

Abb. 1: Geographische Lage der Elfenbeinküste in Westafrika (nach Porembski 1991).

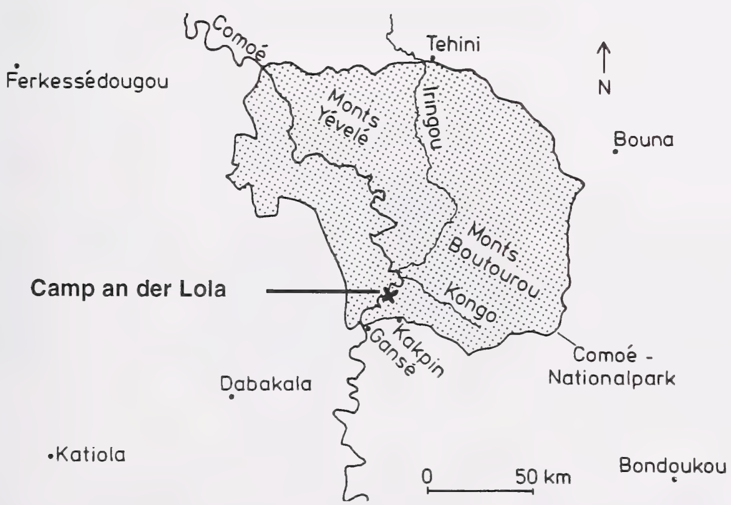

Abb. 2: Comoé-Nationalpark mit seinen wichtigsten Fließgewässern sowie Lage des „Camp an der Lola“ (nach Porembski 1991).

Durch diese Lage im Übergangsbereich zwischen Guinea- und Sudan-Zone ergibt sich ein mosaikartiges Landschaftsbild, das durch die jeweils kleinräumig vorherrschenden Klima-, Boden- und Wasserverhältnisse bestimmt wird. Dominante Vegetationseinheiten sind die Savannenformationen, Galeriewälder und Inselwälder, als kleinräumig strukturierende Einheiten sind Termitenhügel, Felsplateaus, Savannentümpel und vegetationsarme Alluvialflächen (plaine) zu nennen. Für eine ausführliche Darstellung der Vegetation sei auf Porembski (1991) verwiesen.

Die Regenzeit hatte 1993 sehr früh begonnen (erste Niederschläge Ende Februar, Abb. 3), so daß ideale Bedingungen für eine Arbeit an Cicindeliden herrschten, da die Imagines mit Einsetzen der Regenfälle zahlreich erscheinen, um dann im Verlauf der Regenzeit mit zunehmender Vegetationshöhe wieder abzunehmen bzw. zu verschwinden.

Material und Methoden

Im oben beschriebenen Untersuchungsgebiet wurden täglich verschiedene Habitate abgegangen, in denen Sandlaufkäfer auftraten. Von jeder zum ersten Mal angetroffenen Art wurden ein bis fünf Exemplare mit einem Handkescher gefangen und mit Ethylacetat abgetötet. Alle wichtigen Parameter des Habitates (Bodenbeschaffenheit und -feuchtigkeit, Laubschicht, Bodenbewuchs, Vegetationsform, Besonnung, Wassernähe etc.) notierte ich auf Fundortzetteln, die den Käfern beigefügt wurden. Zusätzlich hielt ich fest, welche bereits bekannten Arten mit der jeweiligen Art vergesellschaftet waren oder ob neue Artenkombinationen zu beobachten waren. Außerdem erhielt ich gesammelte Exemplare und Daten zu einigen Arten aus der Zeit vom 20. 5.—11. 6. 1993 von Mark Oliver Rödel.

In einem Fall wurden sämtliche Sandlaufkäfer abgefangen, die sich auf einer feuchten Schlickfläche aufhielten, und danach konserviert. Am nächsten Tag wiederholte ich den quantitativen Abfang, um die Wiederbesiedlungsfähigkeit der vorher angetroffenen Arten zu untersuchen. Bei drei Arten (*E. walterhorni*, *E. planatoflavum* und *R. cinctus*) wurden im Bereich des Galeriewaldes einzelne Exemplare mit farbigen Lackfarben individuell markiert, um deren Aktivität im Tagesverlauf und über die Wochen beobachten zu können.

Nach Rückkehr wurden sämtliche Käfer (267 Individuen) einheitlich präpariert und anschließend unter einem Stereomikroskop mit Meßokular vermessen (Mandibellänge: Jeweils die linke Mandibel, von der außenliegenden Gelenkstelle bis zur Mandibelspitze; Körperlänge: Vom Kopf (sine labro) bis zum Apex der geschlossenen Elytren). Wenn vorhanden, wurden pro Art 10 ♂ und 10 ♀ vermessen. Einige Arten lagen allerdings in geringerer Anzahl oder sogar nur als Einzelexemplare vor. Da bei den in ausreichender Anzahl vorhandenen Arten die Variabilität vor allem der Mandibellänge äußerst gering war (einzige Ausnahme: *C. chrysopyga* mit ausgeprägtem Sexualdimorphismus), wurden die in geringerer Anzahl vorhandenen Arten in die Analyse miteinbezogen. Es wurde bei jeder Art der Mittelwert und die Standartabweichung für die Geschlechter separat berechnet. Falls sich die Mandibellängen von ♂ und ♀ nicht signifikant unterschieden, wurden die Werte gepoolt.

Die Bestimmung erfolgte mit Primärliteratur und umfangreichen Vergleichssammlungen (Zoologische Staatssammlung München und Sammlung Museum Frey sowie den Privatsammlungen von K. Werner, Peiting, und W. Lorenz, Tutzing). Teile des bearbeiteten Materials befinden sich in der Zoologischen Staatssammlung München (ZSM), im Zoologischen Forschungsinstitut und Museum Alexander Koenig, Bonn (ZFMK) und in der Sammlung des Autors. Die taxonomische Einordnung der einzelnen Arten und Großtaxa folgt dem „Verzeichnis der Sandlaufkäfer der Welt“ von Wiesner (1992).

Faunistik und Zoogeographie

In einem Gebiet von ca. 10 km^2 Größe wurden 23 Cicindelidenarten nachgewiesen. Davon waren vier Arten bisher für die Elfenbeinküste unbekannt (*L. fimbriata*, *H. nilotica*, *C. lutaria* und *M. flavidens*). Eine Art (*Dromicoida elegantia*) war unbe-

schrieben (Werner 1995). Nicht im Comoé-Nationalpark nachgewiesen wurden *E. deyrollei*, *R. feisthameli*, *H. caternaulti*, *C. flavomaculata* ssp. *tripunctata*, *L. saraliensis* und *C. decellei*, die von anderen Gebieten der Elfenbeinküste bekannt sind (siehe unten). Damit sind insgesamt 29 Sandlaufkäferarten für die Elfenbeinküste nachgewiesen. Das ca. 10 km^2 große Gebiet innerhalb des Comoé-Nationalparks beherbergt demzufolge 79 % aller Arten, die bisher für die Elfenbeinküste nachgewiesen wurden, und zeugt von der hohen Habitatsdiversität des Nationalparks durch dessen Mosaikstruktur (siehe „Untersuchungsgebiet"). Es wäre zu untersuchen, inwieweit einzelne Arten auf dieses Mosaik angewiesen sind, indem sie im Tages- oder Jahresverlauf bzw. als Larven und Imagines diese unterschiedlichen Bio-

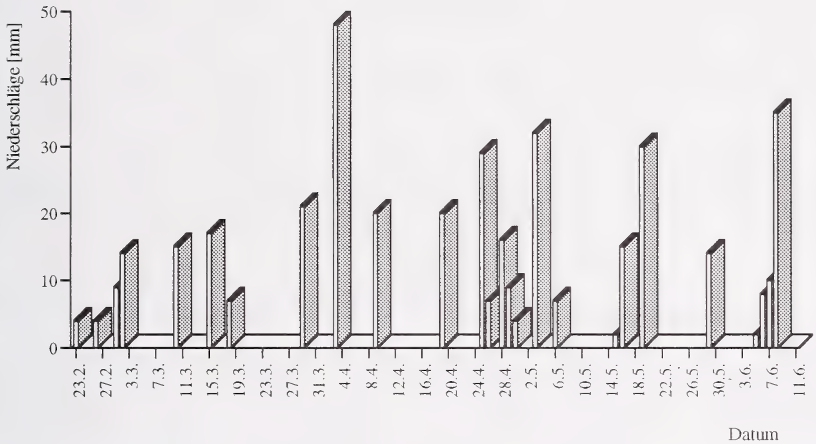

Abb. 3: Niederschlagsverteilung vom 23. 2.—11. 6. 1993 im Bereich des „Camp an der Lola" zu Beginn der Regenzeit.

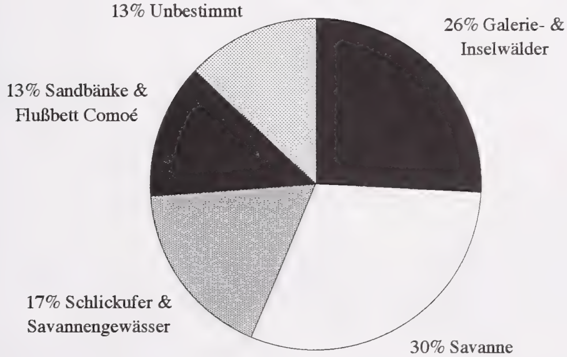

Abb. 4: Verteilung der 23 nachgewiesenen Arten in den Großbiotopen (unbestimmt: bevorzugtes Biotop konnte nicht ermittelt werden, z. B. Lichtfänge).

tope nutzen. Einige beobachtete Arten scheinen auch Hinweise auf diese Annahme zu liefern (siehe Beschreibung *E. walterhorni*, *E. planatoflavum* und *L. neglecta*).

Der Anteil von Savannen- und Galeriewaldarten im Untersuchungsgebiet ist annähernd gleich groß und entspricht der Vegetationszusammensetzung im südlichen Teil des Nationalparks (Porembski 1991), der im Vergleich zum nördlichen einen noch relativ hohen Anteil an immergrünen Waldbereichen (Galerie- und Inselwälder) aufweist (Abb. 4). Problematisch bei einer solchen Zuordnung der Arten ist die Tatsache, daß manche Cicindeliden Übergangsbereiche besiedeln oder im Tages- bzw. Jahresverlauf von einem Großbiotop in ein anderes wechseln (siehe oben). Insgesamt entspricht aber das Verteilungsmuster demjenigen, das man auf Grund der Mosaikstruktur des Untersuchungsgebietes erwartet, und die meisten Arten zeigen eine strenge Habitatsbindung.

Betrachtet man die Verbreitungsgebiete aller für die Elfenbeinküste nachgewiesenen Sandlaufkäferarten, so zeigt sich, daß *Dromicoida elegantia* „endemisch" in der Elfenbeinküste und dort im Norden vorkommt. Dies stützt sich aber bisher nur auf die drei im Comoé-Nationalpark gesammelten Exemplare, und man kann daher davon ausgehen, daß sich mit Sammlungen in Nachbarländern die Kenntnis des Verbreitungsgebietes erweitern wird. Es fällt auf, daß nur 3 Arten (ca. 10 %) ein im Bereich der Elfenbeinküste beschränktes Verbreitungsgebiet und ebenfalls nur 4 Arten (ca. 14 %) eine rein westafrikanische Verbreitung besitzen (siehe Tab. 1).

Tabelle 1: Verbreitungsmuster der 29 in der Elfenbeinküste vorkommenden Arten innerhalb Afrikas.

Elfenbeinküste „endemisch" (1 Art)	Elfenbeinküste & Nachbarländer (3 Arten)	Elfenbeinküste & Westafrika (4 Arten)	Elfenbeinküste & weitere Verbreitung Afrika (21 Arten)
D. elegantia	*E. walterhorni* *E. planatoflavum* *C. decellei*	*M. bocandei* *M. denticollis* *H. caternaulti* *M. plurinotata*	*P. concinna* *P. leprieurii* *E. lugubris* *E. deyrollei* *R. vittatus* *R. feisthameli* *R. nysa* *R. cinctus* *H. interruptum* *C. flavomaculata* *L. fimbriata* *L. neglecta* *L. luxerii* *L. saraliensis* *H. nilotica* *C. lutaria* *C. octoguttata* *M. flavidens* *M. fastidiosa* *M. melancholica* *C. chrysopyga*

Dagegen kommen 21 der vertretenen Arten (ca. 72 %) über große Bereiche Afrikas vor. Davon erreichen *H. nilotica* und *M. fastidiosa* ssp. *vicina* Nordafrika, *P. leprieurii* den Yemen und *M. melancholica* dringt über Südeuropa bis nach Indien vor. Der geringe Endemismusgrad und die kleine Anzahl von Arten mit eingeschränktem Verbreitungsgebiet ist kennzeichnend für die Cicindelidenfauna Westafrikas (siehe auch Pearson & Cassola 1992). Dies steht im scharfen Kontrast zu Ost- und Südafrika, die teilweise einen sehr hohen Prozentsatz endemischer Arten aufweisen (vor allem Länder wie Äthiopien, Kenia, Tansania, Somalia, Mozambique und Südafrika), aber auch Zentralafrika (Kamerun, Zaire und Angola). Dies könnte darin begründet sein, daß die Sudan/Sahel-Zone in Westafrika ein relativ barrierearmes Areal darstellt (vor allem durch das Fehlen großer Gebirgsstöcke) und paläoklimatisch die weite Ausbreitung von Savannen- und Steppenformationen zu den Maxima der Eiszeiten (Livingstone 1975) nur bedingt die Bildung von Endemismen in solchen Habitaten förderte.

Verzeichnis der für den Comoé-Nationalpark nachgewiesenen Sandlaufkäferarten

Subfam. Cicindelinae Csiki, 1906
- Tribus Megacephalini Csiki, 1906
    - *Megacephala bocandei bocandei* Guerin, 1848
    - *Megacephala denticollis schultzeorum* W. Horn, 1904
- Tribus Cicindelini Sloane, 1906
    - Subtribus *Prothymina* W. Horn, 1908 (sensu Rivalier, 1971)
        - *Prothyma concinna erythrocnema* Chaudoir, 1850
        - *Prothyma leprieurii* (Dejean, 1831)
        - *Euryarthron walterhorni* Cassola, 1983
        - *Euryarthron planatoflavum* (W. Horn, 1922)
    - Subtribus *Cicindelina* W. Horn, 1908
        - *Dromicoida elegantia* (Werner, 1995)
        - *Elliptica lugubris* (Dejean, 1825)
        - *Ropaloteres vittatus* (Fabricius, 1801)
        - *Ropaloteres nysa* (Guerin, 1849)
        - *Ropaloteres cinctus* (Olivier, 1790)
        - *Hipparidium interruptum* (Fabricius, 1775)
        - *Lophyridia fimbriata* (Dejean, 1831)
        - *Lophyra neglecta* (Dejean, 1825)
        - *Lophyra luxerii* (Dejean, 1831)
        - *Habrodera nilotica* (Dejean, 1825)
        - *Cylindera lutaria* (Guerin, 1849)
        - *Cylindera octoguttata* (Fabricius, 1787)
        - *Myriochile fastidiosa vicina* (Dejean, 1831)
        - *Myriochile flavidens* (Guerin, 1849)
        - *Myriochile plurinotata* (Audouin & Brulle, 1839)
        - *Myriochile melancholica* (Fabricius, 1798)
        - *Cratohaerea chrysopyga* (W. Horn, 1892)

Verzeichnis der Cicindelidenarten, die für die Elfenbeinküste, aber nicht den Comoé-Nationalpark nachgewiesen sind

Elliptica deyrollei (Guerin, 1849)
- „Lamto-Savanne“ (Lecordier 1972)

Ropaloteres feisthameli (Guerin, 1849)
- „Korogho á Boundiali; leg. Schmitz“ (Basilewsky 1968)

Hipparidium caternaulti (Guerin, 1849)
„Bingerville, Koun-Abronso, Akoupé; leg. Decelle" (Basilewsky 1968)
Calochrea flavomaculata tripunctata (Dejean, 1837)
„Korogho á Boundiali; leg. Schmitz" (Basilewsky 1968)
Lophyra saraliensis (Guerin, 1849)
„Bingerville; leg. Decelle" (Basilewsky 1968)
Cylindera decellei Basilewsky, 1968
„Gagnoa, Korea, Aboisso, Abengourou; leg. Decelle" (Basilewsky 1968)

Bemerkungen zur Biologie der Sandlaufkäferarten

Megacephala bocandei. — 5 Exemplare in Eimern einer Anlage zum Fangen von Amphibien, Umgebung Lola-Tümpel, Lola-Plaine (4./10./13./19. 4.). 1 Exemplar im Übergangsbereich Savanne/Galerie (Camp) nachts am Licht. Nachtaktive, flugunfähige Savannenart, die im Comoé-N. P. nur im Bereich der Alluvialflächen gefunden wurde. Verbreitung der Nominatform: Senegal, Guinea Bissau, Guinea, Elfenbeinküste, Ghana, Togo, Benin, Nigeria.

Megacephala denticollis schultzeorum. — 3 Exemplare nachts im Galeriewald des Comoé (Camp), jeweils einen Tag nach Regenfällen (2 Exemplare am 19. 3., am 18. 3.: 7 mm Niederschlag; 1 Exemplar am 10. 4., am 9. 4.: 20 mm). Nachtaktive, flugunfähige Waldart, im Galeriewald entlang des Comoé auf Laubstreu, zum Teil im Licht der Campbeleuchtung jagend, aber nicht vom Licht „festgehalten". Verbreitung der Unterart: Elfenbeinküste, Obervolta, Togo, Benin, Nigeria, N-Kamerun.

Prothyma concinna erythrocnema. — 9 Exemplare, meist im Galeriewald oder Übergangsbereich Galerie/Savanne, im Halbschatten bis Schatten auf Laubstreu, oft im Schutz des breitblättrigen Grases *Oplismenus hirtellus* (L.) jagend, das im Unterwuchs der Galerie häufig anzutreffen ist und lückenhafte Bestände bildet. Diese Art wurde auch zweimal in Inselwäldern auf unbewohnten und stark zerfallenen Termitenhügeln angetroffen. Alle beobachteten Exemplare traten einzeln auf, sie hielten sich aber meist in Waldbereichen auf, die auch von *E. walterhorni*, *E. planatoflavum* und *R. cinctus* besiedelt waren. Flugunfähig. (10./11./15./ 21./26. 4.//24. 5.//7. 6.) Verbreitung der Unterart: Elfenbeinküste, Guinea, Äthiopien, Liberia, Tschad, Sierra Leone.

Prothyma leprieurii. — 1 Exemplar. Ein ♀ kam am 15. 6. ans Licht. K. Werner (mündl. Mitteilung) berichtet, daß er diese Art bisher ebenfalls nur an Lichtquellen fangen konnte. Verbreitung der Art: Westafrika, Senegal, Tschad, NO-Zaire, Äthiopien, Jemen.

Euryarthron walterhorni. — 19 Exemplare, im Galeriewald oder dessen Randbereichen. Am Vormittag bis ca. 11.00 Uhr wurden Individuen öfters im galerienahen Savannenbereich gefunden, die sich später im Waldsaum aufhielten. Das gleiche Verhalten zeigte auch *E. planatoflavum*. Unter Umständen handelt es sich dabei um einen diurnalen Standortwechsel zur Thermoregulation, wobei sich die Tiere in der Savanne vormittags aufwärmen, bis der Galeriewald geeignete Bodentemperaturen oder Sonnenflecken aufweist, um dann in den inneren Bereich des Waldes zu wechseln. *E. walterhorni* ist flugunfähig und hält sich im Wald auf lichten Stellen auf, die mit Fallaub bedeckt und lückenhaft mit der Poaceae *Oplismenus hirtellus* bestanden sind, unter die sich die Tiere bei Gefahr flüchten und dort regungslos verharren. Häufig mit *E. planatoflavum*, teilweise mit *P. concinna* und *R. cinctus* vergesellschaftet. (4./11./12./15./21. 4.) Verbreitung der Art: Mali (Koulikoro), Elfenbeinküste (Sirakoro); (Cassola 1983).

Euryarthron planatoflavum. — 20 Exemplare, im Galeriewald auf offenen Stellen mit spärlichem Unterwuchs, z. T. auf kleinen Fußwegen oder Hüttenvorplätzen des Camps im Galeriewald, seltener im Bereich von lehmig-kiesigen Nilpferdfurten. Ähnliches shuttle-Verhalten wie *E. walterhorni*. Individuell markierte Tiere konnten über Wochen am gleichen Standort beobachtet werden, zum Teil auf Flächen von nur wenigen Quadratmetern. Diese Art war meistens mit *E. walterhorni* und *R. cinctus* vergesellschaftet, teilweise auch mit *P. concinna* und einmal mit *H. interruptum*. Flugfähig. (2./4./12./15./21. 4.) Verbreitung der Art: Elfenbeinküste (Dimbroko; Horn 1922), Obervolta (Ouagadougou; Coll. Werner, unveröff.).

Dromicoida elegantia. — 3 Exemplare. Leider konnten von dieser interessanten Art nur drei Individuen beobachtet und gefangen werden. Ein ♂ jagte auf einem sandigen Fahrweg im

Bereich der offen Waldsavanne und flog bei Annäherung in angrenzende grasbestandene Flächen. Ein weiteres ♂ hielt sich am Fuß eines stark zerfallenen Termitenhügels auf, wo es kleine sandfarbene Ameisen jagte, möglicherweise die gleiche Art, die auch *C. chrysopyga* fraß. Dieses Tier zeigte keine nennenswerten Fluchtreaktionen, so daß man sich bis auf wenige Zentimeter annähern konnte. Das dritte Exemplar, ein ♀, kam nachts im Camp ans Licht, d. h. im Übergangsbereich Savanne/Galeriewald. Auf Grund der Tatsache, daß die Daten zu dieser Art äußerst dürftig und uneinheitlich sind, können kaum Aussagen über ihre Lebensweise getroffen werden, außer daß es sich wahrscheinlich um eine Savannenform handelt. (12./19. 4.//11. 6) Verbreitung der Art: Bisher nur vom Comoé-N. P./Elfenbeinküste bekannt.

Elliptica lugubris. — 6 Exemplare, große und häufige Art der offenen Savannenwälder und Alluvialflächen. Die meisten beobachteten Tiere jagten zwischen den Horsten der frisch austreibenden Savannengräser auf sandig-lehmigen Freiflächen in voller Besonnung. Wenige Exemplare wurden auch auf sandigen Fahrwegen angetroffen, eines kam an eine Lichtfalle, die sich in der Savanne befand. Flugfähig. Zusammen mit *L. luxerii* auftretend und im gleichen Großbiotop wie *M. plurinotata* und *D. elegantia* (7./10./12./26. 4.) Verbreitung der Art: Senegal, Guinea, Mali, Sierra Leone, Elfenbeinküste, Togo, Nigeria, Kamerun, Äquatorialguinea, Zentalafr. Republik, Uganda, Kenia, Zaire.

Ropaloteres vittatus. — 1 Exemplar, in der Mittagshitze auf sandigem Fahrweg im Bereich der offenen Savannenwälder, im Randbereich der Lola-Plaine (Alluvialfläche). Flugfähig. (6. 4.) Verbreitung der Art: Senegal, Elfenbeinküste (Lamto-Savanne; Lecordier 1972), Sudan, Zaire, Nigeria, Zentralafr. Republik.

Ropaloteres nysa. — 5 Exemplare, bis auf ein Exemplar wurden alle Tiere nachts am Licht im Camp gefangen, das heißt im Übergangsbereich von Galeriewald zu einer Alluvialfläche (Lola-Plaine). 1 Exemplar hielt sich auf einem sandigen Streifen auf, der von dichten Gräsern bestanden war und im Saumbereich des Galeriewaldes liegt. Unter Umständen lebt diese Art im Comoé-N. P. im Randbereich von Galerie und Alluvialflächen bzw. Savannenwäldern. Flugfähig. (13./20./21. 4.) Verbreitung der Art: Senegal, Ghana, Togo, Elfenbeinküste, Sierra Leone, Kamerun, Zentralafr. Republik, Zaire, Uganda, Kenia, Sudan, Äthiopien.

Ropaloteres cinctus. — 20 Exemplare. Waldart, die häufig im Galeriewald anzutreffen ist, aber auch in Inselwäldern auftritt. Im Bereich des Camps vor allem auf sandig-lehmigen, halbschattigen kleinen Fußwegen und Hüttenvorplätzen. In gewissem Maß als „kulturfolgend" zu bezeichnen, da die höchsten Individuendichten im Camp auftraten. *R. cinctus* bevorzugt offene Stellen des Waldbodens zum Jagen, flüchtet aber in dichte Laubstreu oder auf Blätter der angrenzenden Vegetation bis in ca. 50 cm Höhe. Nachts wurden öfters einzelne Tiere angetroffen, die auf bodenfernen Blättern saßen. Diese Übernachtungsplätze werden wahrscheinlich zum Schutz vor nachtaktiven, vagilen Prädatoren, wie z. B. *Megacephala denticollis*, Skorpionen, Solifugen und Spitzmäusen, aufgesucht (siehe auch Beobachtungen von individuellen und kommunalen Schlafplätzen einiger Sandlaufkäferarten in Peru: Pearson & Anderson 1985). Individuell markierte Tiere zeigten, daß diese Art ebenso wie *E. walterhorni* und *E. planatoflavum* sehr standorttreu ist. *R. cinctus* trat nur innerhalb der Waldbereiche auf. Ein in Copula befindliches ♀ wurde dabei beobachtet, wie es eine ca. 1.5 cm große Ponerine, *Paltothyreus tarsatus* Forell, fraß (M. O. Rödel, mündl. Mitteilung). U. Braun, ebenfalls mündl. Mitt., beobachtete *R. cinctus* einige Male beim Fressen dieser wehrhaften Ameise, konnte aber nicht sehen, ob sie von den Cicindeliden aktiv erbeutet worden waren. Werner (1993b) berichtet, daß er *R. cinctus* mit „einer großen schwarzen Ameise" in den Mandibeln antraf. Vergesellschaftet ist *R. cinctus* im Comoé-N. P. regelmäßig mit *E. planatoflavum*, scheint aber im Gegensatz zu dieser die etwas offeneren Stellen des Bodens im gemeinsam besiedelten Bereich zu nutzen. Außerdem tritt sie mit *E. walterhorni* und *P. concinna* auf, wobei diese beiden Arten Bereiche dichter Bodenvegetation bevorzugen. Flugfähig. Die Serie aus dem Comoé-N. P. enthält hauptsächlich rötlichbraune Exemplare mit cremefarbenen Lateralstreifen der Elytren, helle Dorsalmakel sind sehr variabel bzw. fehlen ganz. Einige Tiere besaßen aber auch eine hellgrüne oder schwarze Grundfärbung. (1./2./4./5./10./19./21. 4.) Verbreitung der Art: Guinea, Sierra Leone, Togo, Ghana, Liberia, Elfenbeinküste, Nigeria, Kamerun, Äquatorialguinea, Kongo, Zaire, Gabun (Coll. Fahr), Zentralafr. Republik, Uganda, Sudan, Äthiopien.

Hipparidium interruptum. — 13 Exemplare. Ausgesprochene Waldart, die nur im Vollschatten der Galeriewälder anzutreffen war. Bevorzugter Lebensraum sind schmale, luftfeuchte, durch Erosion tief eingeschnittene temporäre Zuflüsse des Comoé („Nilpferdfurten"), die im Bereich der Sohle ein wechselndes Bodenmosaik aus Sand, Kies und Schlick aufweisen. Außerdem wurde *H. interruptum* im überschatteten Uferbereich der Kongo- und Iringo-Mündung in den Comoé angetroffen, wo sich die Art auf sandigen und nur spärlich mit Laub bedeckten Flächen aufhielt. Insgesamt drei Individuen wurden auf sandigen Flächen innerhalb der Galerie in weiterer Entfernung vom Fluß beobachtet. *H. interruptum* ist eine scheue, gewandt fliegende Art, die bei Annäherung über verhältnismäßig lange Strecken (bis ca. 30 m) flüchtet. Dabei werden die leuchtend metallisch-roten Tergite sichtbar. In einem Fall trat *H. interruptum* zusammen mit *C. octoguttata* (im Uferbereich der Kongo-/Comoé-Mündung) auf. (22. 3.//7./15./18./23./26. 4.) Verbreitung der Art: Senegal, Guinea, Sierra Leone, Liberia, Elfenbeinküste, Nigeria, Kamerun, Zentralafr. Republik, Gabun, Zaire, Kongo, Äquatorialguinea, Angola.

Lophyridia fimbriata. — 10 Exemplare. Diese Art wurde nur auf einer ausgedehnten Sandbank gefunden, die sich zungenförmig vom Ufer in den Comoé erstreckte. Im völlig vegetationsfreien Bereich der Sandbank trat *L. fimbriata* in hoher Dichte auf, wobei die erhabenen Stellen in der Mitte der Sandbank, wo der Sand trocken war, gegenüber den nassen Bereichen im Spülsaum bevorzugt wurden. *L. fimbriata* war an dieser Sandbank mit *H. nilotica* vergesellschaftet. Dieses gemeinsame Auftreten der beiden Arten ist von vielen Lokalitäten innerhalb des großen Verbreitungsareals von *L. fimbriata* und *H. nilotica* bekannt (z. B. Pearson & Juliano 1991, Werner 1993a). Häufig kommt als weitere Art *Chaetodera regalis* (Dejean) auf solchen gewässernahen, vegetationslosen Sandflächen vor (Pearson & Mury 1979, Pearson & Juliano 1991, Werner 1993a), diese konnte aber im Comoé-N. P. nicht nachgewiesen werden. Erstnachweis von *L. fimbriata* für die Elfenbeinküste. (23. 3//1./12. 4.) Verbreitung der Nominatform: Sudan, Niger, Äthiopien, Kenia, Zentralafr. Republik, Zaire, Kamerun, Senegal, Guinea, Benin, Elfenbeinküste.

Lophyra neglecta. — 21 Exemplare. Individuen dieser Art wurden ab Anfang April auf Sandflächen entlang des Comoé beobachtet. Dabei wurden trockene, nahezu vegetationsfreie und stark besonnte Bereiche bevorzugt, die etwas vom Flußufer entfernt lagen (ähnliche Habitatsansprüche von *L. neglecta intermedia* in Kenia; Werner 1993a). Mit fortschreitendem Ansteigen des Comoé durch die ersten Niederschläge der Regenzeit und der dadurch bedingten Verkleinerung der Sandflächen im Flußbett nahm die Population in diesem Biotop immer mehr ab. Ab dem 10. 4. erschien *L. neglecta* auf einer größeren vegetationslosen und halbschattigen Sandfläche im Randbereich einer Alluvialfläche (Lola-Plaine) und dem Galeriewald des Comoé. Im angrenzenden Bereich, der lückenhaft mit Gräsern bestanden war, jagten drei Exemplare von *Graphipterus voltae* Basilewsky. Zwei Tage später drang *L. neglecta* in den Galeriewald ein, wo sie dann auf halbschattigen und sandigen Hüttenvorplätzen des Camps häufig anzutreffen war. Anscheinend wechselte diese Art mit dem Verschwinden der Sandflächen durch den Anstieg des Comoé das Habitat, wobei sich interessanterweise das neue in Bezug auf Temperatur, Beschattung und Vegetation stark vom ersten unterschied. *L. neglecta* trat auf den Sandflächen, auf denen sie entlang des Comoé gefunden wurde, als einzige Sandlaufkäferart auf, im Bereich des Galeriewaldes wurde je einmal *R. nysa* und *C. octoguttata* zusammen mit ihr beobachtet. (4./5./6./10./12./21./22. 4.) Verbreitung der Nominatform: Senegal, Sierra Leone, Guinea, Elfenbeinküste, Togo, Tschad, Ghana, Nigeria, Zaire, Angola, Kenia, Äthiopien.

Lophyra luxerii. — 1 Exemplar. Auf besonnter, sandiger Fahrspur im Bereich der offenen Waldsavanne. Weitere Exemplare dieser Art wurden ebenfalls in der Savanne angetroffen, wo sie sich meist auf kleinen sandigen Bereichen zwischen lückenhaften Horsten von Gräsern aufhielten. Vergesellschaftet mit *E. lugubris* und im gleichen Großbiotop wie *R. vittatus*, *M. plurinotata* und *D. elegantia* sowie *C. chrysopyga*. (22. 4.) Verbreitung der Art: Senegal, Guinea Bissau, Guinea, Sierra Leone, Elfenbeinküste, Ghana, Togo, Nigeria, Kamerun, Zentralafr. Republik, Gabun, Zaire, Uganda, Sudan, Kenia, Äthiopien.

Habrodera nilotica. — 7 Exemplare. Gleicher Fundort wie *L. fimbriata*. Im Unterschied zu dieser Art hielt sich *H. nilotica* eher am Spülsaum bzw. durchfeuchteten Bereich der Sandbank

im Comoé auf. Eine identische Biotopbeschreibung findet sich bei Rensch (1957) für ein Vorkommen von *H. nilotica* in Oberägypten. Es war zu beobachten, wie einzelne Tiere bei Flucht und zur Nahrungssuche kurze Strecken ins Wasser liefen. Eine ähnliche Trennung in Mikrohabitate wie bei *H. nilotica* und *L. fimbriata* untersuchten Schultz & Hadley (1987) bei *Cicindela oregona* Leconte und *C. tranquebarica* (Herbst), deren Habitatswahlverhalten an einem sandigen Flußufer in Arizona/USA beobachtet wurde. In diesem Fall bevorzugt *C. tranquebarica*, analog zu L. *fimbriata*, die höher gelegenen und trockenen Sandbereiche, während *C. oregona*, analog zu *H. nilotica*, die durchfeuchteten ufernahen Bereiche aufsucht. In ökophysiologischen Experimenten zeigten sie, daß *C. tranquebarica* sowohl eine höhere Letaltemperatur bei 0 % relat. Luftfeuchte (46°—47°C) als auch geringere Wasserverlustraten als *C. oregona* aufwies, die bei 39°—43°C in trockener Luft starb. Unter Umständen liegt bei *L. fimbriata* und *H. nilotica* ein ähnlicher Fall von physiologisch bedingter Mikrohabitatstrennung wie im oben geschilderten vor. Erstnachweis für die Elfenbeinküste. (23. 3.//1./12. 4.) Verbreitung der Nominatform: Sierra Leone, Elfenbeinküste, Togo, Nigeria, Zentralafr. Republik, Kongo, Zaire, Sudan, Äquatorialguinea, Ägypten, Äthiopien, Kenia, Mozambique, Zimbabwe, Südafrika.

Cylindera lutaria. — 18 Exemplare. Dies ist eine von vier dunkel gefärbten, kleinen Cicindelidenarten, die im Comoé-N. P. auf Schlickflächen in Gewässernähe oder auf ausgetrockneten Savannentümpeln vorkommen. *C. lutaria* wurde an drei verschiedenen, jeweils ca. 5 km auseinanderliegenden Savannentümpeln angetroffen, von denen zwei ausgetrocknet waren, der Schlick aber noch feucht und einer mit Wasser gefüllt war, an dem die Art im schlickigen Uferbereich jagte. *C. lutaria* wurde nur im Bereich dieser ephemeren, stehenden Savannengewässer, nicht aber auf Schlickflächen des Comoé und seiner Zuläufe gefunden. Vergesellschaftet war diese Art mit *C. octoguttata*, *M. flavidens* und *M. melancholica*. Erstnachweis für die Elfenbeinküste. (18./21./23. 4.) Verbreitung der Art: Guinea Bissau, Elfenbeinküste, Uganda, Sudan, Zaire, Zentralafr. Republik, Angola, Südafrika.

Cylindera octoguttata. — 29 Exemplare. Kleinste der nachgewiesenen Arten. *C. octoguttata* besiedelt wie die vorhergehende *Cylindera* ebenfalls dunklen, feuchten Schlick als Substrat, zeigt aber eine größere ökologische Plastizität, da sie nicht nur im Bereich von stehenden bzw. ausgetrockneten Savannengewässern vorkommt, sondern auch häufig im schlickigen Spülsaum des Comoé und seiner Zuflüsse zu finden war. Insgesamt drei Exemplare wurden im Untersuchungszeitraum in einem abweichenden Biotop gefunden: Sie hielten sich im halbschattigen Bereich der sandigen Fußwege und Hüttenvorplätze des Camps innerhalb des Galeriewaldes auf (7.4.: ♀, 18. 4.: ♀, 21. 4.: ♂). Macfie (1922) berichtet, daß er in Accra (Ghana) häufig *C. octoguttata* dabei beobachtet hat, wie sie im Uferbereich von Pfützen und Tümpeln nach *Anopheles costalis*- und Culiciden-Larven „fischte", indem die Tiere mit den Beinen im Wasser standen und beim Fangen der Beute mit dem Kopf ins Wasser tauchten. *C. octoguttata* trat zusammen mit *C. lutaria*, *M. flavidens* und *M. melancholica* auf. (27. 3.//3./6./7./8./12./18./21./23. 4.) Verbreitung der Art: Senegal, Sierra Leone, Elfenbeinküste, Liberia, Guinea, Ghana, Togo, Nigeria, Kamerun, Zentralafr. Republik, Mali, Benin, Zaire, Gabun, Sudan, Äthiopien, Äquatorialguinea, Kongo, Angola, Namibia, Südafrika, Fernando Poo.

Myriochile flavidens. — 14 Exemplare. Ebenfalls wie *C. lutaria* und *C. octoguttata* eine kleine, dunkel gefärbte Art, die nur an zwei relativ großen Savannentümpeln im Comoé-N. P. gefunden wurde. In einem Fall hielt sie sich im feuchten Schlickbereich des Tümpelufers auf, im anderen auf einer ca. 100 m^2 großen Schlammfläche, die zu diesem Zeitpunkt kein offenes Wasser mehr besaß. Ähnlich wie *C. lutaria* war auch *M. flavidens* nur im Bereich dieser stehenden, ephemeren Savannengewässer zu finden. Die ♂ von *M. flavidens* besitzen im Unterschied zu den ♀ auffällig weiß gefärbte Mandibeln, so daß sie sich selbst für den Betrachter deutlich vom dunklen Untergrund abheben. Pearson (1988) beschreibt ähnliche Verhältnisse im Falle von *H. xantophilum* W. Horn in Gabun (Makokou). Er beobachtete, wie die ♂ vor potentiellen Paarungspartnern stehenblieben und ihre Mandibeln in schneller Folge öffneten und schlossen. Mit *C. lutaria*, *C. octoguttata* und *M. melancholica* und in einem Fall auch mit *M. fastidiosa vicina* vergesellschaftet. Erstnachweis für die Elfenbeinküste. (8./21./23. 4.//21. 5.) Verbreitung der Nominatform: Guinea Bissau, Guinea, Sierra Leone, Elfenbeinküste, Obervolta, Togo, Nigeria, Kamerun, Zentralafr. Republik, Zaire, Uganda, Sudan, Äthiopien.

Myriochile fastidiosa vicina. — 4 Exemplare. M. O. Rödel sammelte drei Individuen am Licht der Campbeleuchtung im Übergangsbereich Alluvialfläche/Galeriewald. Ein Exemplar wurde zusammen mit *M. flavidens* auf dunklem Schlick einer vegetationslosen Pfütze gefangen. In Äthiopien fand K. Werner (mündl. Mitt.) diese Art auf dünn mit Gras bestandenem, lehmigem Boden. (21. 5.) Verbreitung der Unterart: Mauretanien, Senegal, Guinea, Sierra Leone, Liberia, Elfenbeinküste, Mali, Obervolta, Ghana, Kamerun, Niger, Tschad, Sudan, Äthiopien, Uganda, Tansania, Zaire, Zentralafr. Republik, Kongo, Äquatorialguinea, Angola, Namibia, Malawi, Zimbabwe.

Myriochile plurinotata. — 9 Exemplare. Als einzige der kleinen, dunkel gefärbten Sandlaufkäferarten wurde *M. plurinotata* nicht auf feuchtem, meist in Gewässernähe befindlichem Substrat gefunden, sondern trat immer nur in Einzelexemplaren verstreut auf sandigen Flächen, z. B. Fahrwegen, auf. Vier Exemplare wurden nachts am Licht im Randbereich von Galeriewald und Savanne gefangen. Die tagsüber beobachteten Tiere hielten sich vornehmlich im Halbschatten der lückig stehenden Savannenbäume auf. Im gleichen Großbiotop wie *E. lugubris*, *L. luxerii* und *D. elegantia*. (11./20./21. 4.//10./21. 5.) Verbreitung der Art: Mauretanien, Senegal, Mali, Guinea Bissau, Sierra Leone, Elfenbeinküste, Obervolta, Niger, Nigeria, Zentralafr. Republik.

Myriochile melancholica. — 40 Exemplare. Größte Art, die im Comoé-N. P. schlammiges Substrat bewohnt. Überall an Gewässerrändern anzutreffen, wobei anscheinend stehende Savannengewässer bevorzugt werden. Da sich diese erst mit Einsetzen der Regenzeit bilden, war *M. melancholica* zuerst im Bereich des Comoé und kleiner Zuflüsse zu finden, später trat sie als dominante Art vor allem an etwas größeren Savannentümpeln im schlickigen Uferbereich auf. Vergesellschaftet mit *C. lutaria*, *C. octoguttata* und *M. flavidens*, in einem Fall mit *M. fastidiosa vicina*. Das große Verbreitungsgebiet, das von Südeuropa bis Indien reicht und ganz Afrika einschließt, wobei auch ozeanische Inseln besiedelt sind (z. B. Capverden, São Tomé (Coll. Fahr), Seychellen, Comoren, Mauritius etc.), zeugt von der Kolonisationsfähigkeit dieser Art. Insofern scheint sie auch in kleinerem Maßstab dafür prädestiniert zu sein, unvorhersagbare Biotope wie die ephemeren Savannentümpel schnell und erfolgreich zu besiedeln. Solche schlickigen Substrate in Gewässernähe sind besonders zu Beginn der Regenzeit extrem kurzlebig, da der Boden noch wenig durchfeuchtet ist und andererseits hohe Temperaturen und intensive Sonneneinstrahlung vorherrschen, so daß in Abhängigkeit von den Regenfällen geeignete Biotope innerhalb von Tagen bis Stunden entstehen und wieder verschwinden. Sucht man nach geeigneten, d. h. feuchten Schlickflächen, so ist *M. melancholica* fast immer in großer Individuenzahl anzutreffen. (22. 3.//3./8./18./19./23. 4.//21. 5.) Verbreitung der Art: Siehe oben.

Cratohaerea chrysopyga. — 9 Exemplare. Diese auffällig metallisch blau bis grün gefärbte Art war nur auf den bis zu 5 m hohen Termitenbauten von *Macrotermes bellicosus* Smeathman zu finden. Auffälligerweise waren immer nur bestimmte Termitenhügel besetzt, wobei es keinen Unterschied machte, ob die Bauten verlassen oder bewohnt waren. Direkt in der Umgebung befindliche Hügel, die in Bezug auf Besonnung, Vegetation, umgebenden Bodengrund etc. vergleichbar waren, wurden nie besiedelt, während ganz bestimmte Termitenbauten nach dem Abfangen von einzelnen *C. chrysopyga* meist nach ein bis zwei Tagen erneut besetzt waren. Bis auf zwei Fälle, in denen einmal ein Pärchen in Copula und ein andermal ein getrennt laufendes Pärchen auf demselben Hügel gleichzeitig angetroffen wurde, kam diese Art immer nur in Einzelexemplaren auf dem jeweiligen Termitenbau vor. Ebenso waren keine geschlechtsspezifischen Unterschiede festzustellen, d. h. sowohl ♂ als auch ♀ bewohnten dieses für Cicindeliden ungewöhnliche Biotop. Nach dem Abfangen von z. B. einem ♂ erschien auf dem gleichen Hügel wenige Tage später ein ♂ oder ♀ bzw. vice versa. Somit scheint es sich nicht um temporäre Treffpunkte zur Partnerfindung zu handeln, da ungestörte Individuen über Tage auf demselben Termitenbau verweilten und dort beim Jagen beobachtet wurden. Horn (1921) berichtet, daß sich diese Art in Joko/Kamerun angeblich in der Nähe unterirdischer Termitenbauten aufhält. Weiterhin ist es bemerkenswert, daß *C. chrysopyga* nicht wie andere Sandlaufkäferarten ständig umherläuft, sondern z. T. bis zu 25 min. regungslos sitzenbleibt. Bei Annäherung fliegen die Tiere relativ spät auf und landen meist auf der entgegengesetzten Seite des Termitenhügels. Bei größerer Störung fliegen sie entweder vom Hügel fort oder flüchten im Falle von verlassenen Bauten in aufgebrochene Termitengänge.

Es konnten oft Goldwespen (Chrysididae) beobachtet werden, wie sie langsam die Termitenbauten fliegend absuchten. Die Größe und Farbe dieser Tiere ähnelt sehr stark der von *C. chrysopyga*. Ob zwischen diesen beiden Arten irgendeine Form von Wechselbeziehung besteht, konnte nicht festgestellt werden. Wie oben schon erwähnt, verhält sich *C. chrysopyga* auf den Termitenhügeln sehr ruhig, und nur wenige Male wurde beobachtet, wie die Tiere am Fuß ihres Hügel jagten. Die Beute bestand aus winzigen, 1—1.5 mm langen hellgelben Ameisen. Eine weitere Besonderheit zeichnet diese Art gegenüber anderen Cicindeliden aus: Die Mandibeln der ♂ sind im Durchschnitt um den Faktor 1.3 länger als die der ♀, stark sichelförmig und tragen im Gegensatz zu den Mandibeln der ♀ kaum Zähne. Ähnliche Verhältnisse liegen bei der Schwesternart *C. brunet* (Gory) vor, wie an Hand von Museumsexemplaren festgestellt wurde. Unter Umständen dient bei *C. chrysopyga* dieser für Cicindeliden relativ ungewöhnliche Sexualdimorphismus dem ♂ zum besseren Festhalten des ♀ bei der Copulation, da sie sich dabei meist auf den senkrechten Wänden der Termitenbauten befinden. (12./13./19./26. 4.//20. 5.) Verbreitung der Art: Senegal, Sierra Leone, Guinea, Liberia, Elfenbeinküste, Benin, Togo, Kamerun, Zentalafr. Republik, Zaire, Uganda, Kenia.

Artenvergesellschaftungen und Koexistenz

Zur Untersuchung, ob sich interspezifische Konkurrenz in Form einer Merkmalsverschiebung auswirkt (siehe Einleitung), wurden sämtliche Arten in Bezug auf Körper- und Mandibellänge vermessen (siehe Material und Methoden). Die Regressionsgerade (Abb. 5) zeigt, daß Körper- und Mandibellängen linear und positiv miteinander korreliert sind. Die einzigen abweichenden Werte sind die von *L. fimbriata* und den ♂ von *C. chrysopyga*. Mögliche Erklärungen dafür siehe Beschreibung der Biologie von *C. chrysopyga* und für *L. fimbriata* siehe unter „4. Comoé-Sandbänke".

Pearson & Mury (1979) zeigten in Wahlexperimenten, in denen verschiedene Cicindelidenarten zwischen unterschiedlich großer Beute wählen konnten, daß die Mandi-

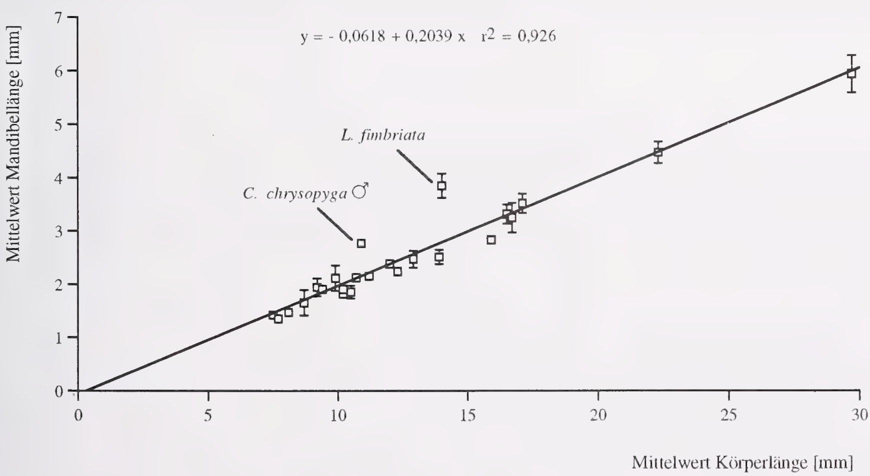

Abb. 5: Korrelation der Körper- und Mandibellängen von 23 Cicindelidenarten (für *C. chrysopyga* sind die Werte nach Geschlecht getrennt aufgetragen). Senkrechte Linien geben die Standardabweichung an.

bellängen der jeweiligen Arten direkt mit der mittleren bevorzugten Beutegröße korreliert sind. Auf Grund verschiedener Mandibellängen könnten somit syntope Sandlaufkäferarten unterschiedliche Beutespektren nutzen und die interspezifische Nahrungskonkurrenz vermindern.

Dieser Ansatz soll im Folgenden für die jeweiligen Biotope untersucht werden. Wichtige Zusatzinformationen wie Beuteabundanz und Größenspektrum konnten auf Grund des beschränkten Untersuchungszeitraumes leider nicht aufgenommen werden. Diese wären für eine genaue Analyse unabdingbar, und so bleiben einige Aussagen spekulativ oder fußen auf nicht-quantitativen Beobachtungen.

1. Galeriewald

Im Bereich des Galeriewaldes traten fünf Arten auf: *P. concinna*, *E. walterhorni*, *E. planatoflavum*, *H. interruptum* und *R. cinctus*. Faßt man diese zusammen und betrachtet ihre Mandibelverhältnisse (Abb. 6; Tab. 2), so scheinen sie nicht der Voraussage einer Merkmalsdivergenz zu folgen. Regelmäßig miteinander vergesellschaftet waren allerdings nur *E. walterhorni*, *E. planatoflavum* und *R. cinctus*, während *P. concinna* und *H. interruptum* meist ohne unmittelbare Begleitarten auftraten (siehe oben, „Bemerkungen zur Biologie" dieser Arten). *E. walterhorni* jagte hauptsächlich im Bereich dichterer Bodenvegetation (vor allem unter den breiten Blättern des Grases *O. hirtellus*), *E. planatoflavum* und *R. cinctus* bevorzugten dagegen offenere Bereiche des Waldbodens. In diesem Zusammenhang ist auch zu bemerken, daß die beiden letztgenannten Arten im Gegensatz zu der ersteren flugfähig sind und daher unterschiedliche Strategien der Prädatorenvermeidung besitzen. Betrachtet man die Arten, die die größte Nischenüberlappung aufweisen, nämlich *R. cinctus* und *E. planatoflavum*, so zeigt sich, daß sie sich in Bezug auf ihre Mandibellängen deutlich unterscheiden (Verhältnis von 1.32; Tab. 2). Auffällig ist auch die Tatsache, daß *H. interruptum* und *R. cinctus*, die an geeigneten Stellen in hoher Dichte auftraten und deren Imagines eine sehr ähnliche Lebensweise führen, nie vergesellschaftet waren und andererseits fast identische Mandibellängen besitzen.

Tabelle 2: Mandibelverhältnisse für Cicindelidenarten (n = Anzahl der vermessenen Individuen; Mittelwert der Mandibellänge) der Galeriewälder.

	E. walterhorni	*E. planatoflavum*	*H. interruptum*	*R. cinctus*
P. concinna (n = 9; 2.38	1.04	1.05	1.37	1.39
E. walterhorni (n = 19; 2.47)		1.02	1.32	1.34
E. planatoflavum (n = 20; 2.51)			1.29	1.32
H. interruptun (n = 13; 3.25)				1.02
R. cinctus (n = 20; 3.32)				—

2. Savanne
In der offenen Waldsavanne wurden fünf Arten angetroffen: *M. plurinotata*, *D. elegantia*, *L. luxerii*, *R. vittatus* und *E. lugubris*. Diese Arten bewohnten den spärlich bewachsenen Boden dieses Großbiotops, während *C. chrysopyga* ausschließlich auf den Termitenhügeln von *M. bellicosus* zu finden war und *C. lutaria*, *C. octoguttata*, *M. flavidens* sowie *M. melancholica* an Gewässerränder innerhalb der Savannen gebunden waren (siehe „3. Savannengewässer/Schlickufer") und offensichtlich nicht in Konkurrenz mit den erstgenannten Arten treten konnten. Daher werden nur diese als Artengemeinschaft behandelt. *D. elegantia* wurde lediglich in drei Exemplaren und in äußerst verschiedenen Kleinbiotopen beobachtet. Auf Grund der Seltenheit

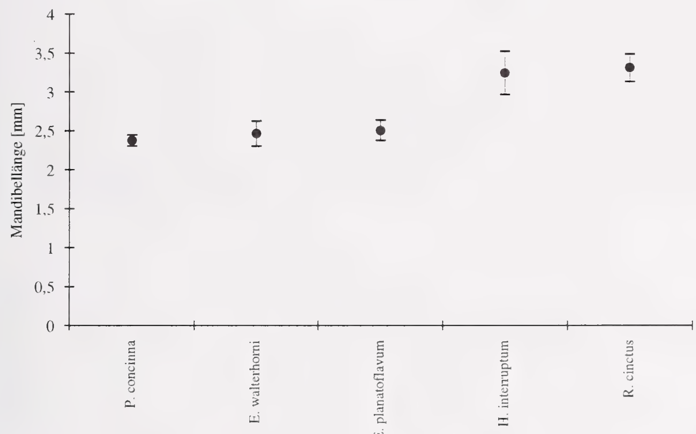

Abb. 6: Mittlere Mandibellängen (Punkte) und Standardabweichung (senkrechte Linien) für Cicindelidenarten der Galeriewälder.

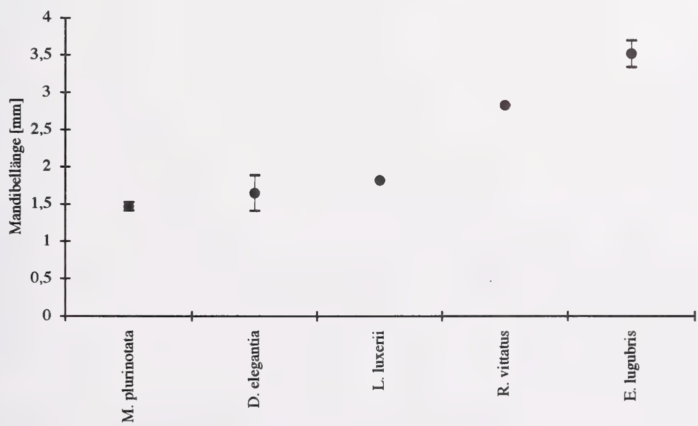

Abb. 7: Mittlere Mandibellängen (Punkte) und Standardabweichung (senkrechte Linien) für Cicindelidenarten der Baumsavanne.

dieser Art im Untersuchungszeitraum und der uneinheitlichen Fundumstände, die keine Zuordnung im Sinne einer Artenvergesellschaftung zulassen, wird sie im Folgenden ausgeschlossen.

Die verbleibenden vier Arten, die in ihrer Imaginalbiologie starke Nischenüberlappung zeigen und sich daher im Sinne einer Konkurrenzvermeidung in mindestens einem Parameter unterscheiden sollten, scheinen in Bezug auf die Mandibellängen den Voraussagen einer Hutchinson-ratio zu folgen: *M. plurinotata*, *L. luxerii*, *R. vittatus* und *E. lugubris* weisen Mandibelverhältnisse von ≧ 1.24 auf (Tab. 3, Abb. 7). Besonders häufig vergesellschaftet waren *L. luxerii* und *E. lugubris*, die einen besonders hohen Wert (1.93; Tab. 3) aufweisen. Die z. T. geringen Stichproben vermessener Individuen lassen allerdings keine Statistik zu.

3. Savannengewässer/Schlickufer

Für die dunkel gefärbten, schlammigen Ufer der Savannentümpel war die Tatsache charakteristisch, daß fast immer unterschiedliche Artenkombinationen anzutreffen waren. Dies steht in deutlichem Kontrast zu den anderen Habitaten, die durch die Voraussagbarkeit der Artenvergesellschaftungen ausgezeichnet waren. Von allen untersuchten Lebensräumen, die von Sandlaufkäfern besiedelt wurden, ist dieses Habitat durch seine Kurzlebigkeit und Unvorhersagbarkeit gekennzeichnet. Beson-

Tabelle 3: Mandibelverhältnisse für Cicindelidenarten (n = Anzahl der vermessenen Individuen; Mittelwert der Mandibellänge) der Baumsavanne.

	D. elegantia	*L. luxerii*	*R. vittatus*	*E. lugubris*
M. plurinotata (n = 9; 1.47)	1.12	1.24	1.93	2.39
D. elegantia (n = 3; 1.65)		1.10	1.72	2.13
L. luxerii (n = 1; 1.82)			1.55	1.93
R. vittatus (n = 1; 2.83)				1.24
E. lugubris (n = 6; 3.52)				—

Tabelle 4: Individuenzahl von drei Cicindelidenarten, die an zwei folgenden Tagen auf einer Schlickfläche quantitativ abgefangen wurden.

	18. 4. 1993	19. 4. 1993
C. lutaria	1	—
C. octoguttata	1	—
M. melancholica	13	11

ders zu Beginn der Regenzeit füllen sich nach Niederschlägen Senken und Mulden mit Wasser, um dann häufig im Verlauf der folgenden Tage durch die starke Sonneneinstrahlung wieder auszutrocknen. Die von *C. lutaria*, *C. octoguttata*, *M. flavidens* und *M. melancholica* besiedelten Bereiche, schlammige Gewässerränder oder größere Schlickflächen, verändern sich demzufolge von Tag zu Tag erheblich. Zur Untersuchung, ob die Artenkombinationen auf Grund der Unvorhersagbarkeit des Habitates zufällig zustandekommen, wurden auf einer ca. 20 m^2 großen Schlickfläche, die nach dem Austrocknen eines Savannentümpels entstanden war, sämtliche Cicindeliden abgefangen. Zu diesem Zeitpunkt war nur noch eine kleine Pfütze vorhanden. Am nächsten Tag wurde der quantitative Abfang wiederholt (Tab. 4). Am dritten Tag war die Oberfläche des Schlicks trocken und keine weiteren Cicindeliden anzutreffen. Durch die Schwierigkeit, eine sowohl vom Zeitpunkt als auch von der Größe (Übersichtlichkeit) geeignete Fläche zu finden, war diese Untersuchung daher auf diese beiden Abfänge beschränkt.

An beiden Tagen war *M. melancholica* annähernd gleich häufig vertreten. *C. lutaria* und *C. octoguttata* waren dagegen am ersten Tag nur in Einzelexemplaren vorhanden und fehlten am zweiten Tag vollständig. Dieses Ergebnis befindet sich im Einklang mit der Beobachtung, daß *M. melancholica* an fast allen untersuchten Schlickflächen auftrat und oft die dominierende Art war. *C. octoguttata* zeigte ein ähnliches Verbreitungsmuster, wobei sie im Gegensatz zu den anderen schlickbewohnenden Arten auch an den Ufern von Fließgewässern zu finden war. *C. lutaria* und *M. flavidens* dagegen konnten nur im Bereich stehender oder ausgetrockneter Savannentümpel nachgewiesen werden. Außerdem war auffällig, daß die beiden letzteren Arten meist an solchen Biotopen auftraten, die schon eine gewisse Zeit bestanden hatten. Daher stellt sich die Frage, ob es sich bei den jeweils vorgefundenen Artenkombinationen (es traten sowohl alle vier hier behandelten Arten als auch unterschiedliche Kombinationen gemeinsam auf) um Sukzessionsstadien zum jeweiligen Zeitpunkt handelt oder ob diese durch zufällige Besiedelungsereignisse jeweils stochastische Gemeinschaften darstellen. Zur Klärung dieser Frage wäre jedoch eine größere Anzahl von Experimenten notwendig. *M. melancholica* und in geringerem Maße *C. octoguttata* scheinen in jedem Fall verbreitungsstarke Arten zu sein, was man vor allem an Hand der zoogeographischen Verbreitung von *M. melancholica* sehen kann (siehe oben, „Bemerkungen zur Biologie" dieser Art), und daher für eine schnelle und erfolgreiche Besiedelung solcher ephemeren Biotope prädestiniert.

Betrachtet man die Mandibelverhältnisse (Abb. 8; Tab. 5), so liegen alle Arten in einem sehr engen Bereich. Dies kann mehrere Gründe haben: Zum einen besteht die Möglichkeit, daß das Größenspektrum der Beutetiere sehr eng ist und dadurch bedingt keine Nischendifferenzierung in diesem Parameter möglich ist. Für diese Annahme gibt es auf Grund von Freilanduntersuchungen an vergleichbaren Gewässerrändern in Arizona/USA einige Hinweise (Pearson & Mury 1979, Pearson & Knisley 1985). Dort war sowohl die Beuteabundanz als auch das Größenspektrum im Vergleich zu anderen von Cicindeliden besiedelten Biotopen stark eingeschränkt. Beobachtungen dieser Art konnten auch im Comoé-N. P., allerdings ohne quantitative Daten (siehe Einleitung), gemacht werden.

Zum anderen könnte es sein, daß Arten, die auf solche ephemeren Biotope spezialisiert sind, ihre Beute in sehr kurzer Zeit möglichst effektiv nutzen müssen. Falls

diese unvorhersagbare Ressource ein geringes Größenspektrum aufweist, wären wie im obigen Fall die Arten auf dieses festgelegt. Interspezifische Konkurrenz könnte in diesem Fall unter Umständen durch die stochastische Besiedelung dieser Biotope herabgesetzt sein.

4. Comoé-Sandbänke

Auf den Sandbänken des Comoé wurden drei Arten angetroffen: *L. neglecta*, *H. nilotica* und *L. fimbriata*. Interessanterweise wurde *L. neglecta* nie mit *H. nilotica* und *L. fimbriata* zusammen vorgefunden, sondern immer nur alleine: *L. neglecta* und *H. nilotica* besitzen fast identische Mandibellängen, und falls im Bereich der Sandbänke Nahrungskonkurrenz eine starke Rolle spielt, sollte man auch diese Artenkombination nicht antreffen. Insofern scheinen diese Arten durch unterschiedliche Mikrohabitatswahl (siehe oben, „Bemerkungen zur Biologie“) separiert zu sein. *H. nilotica* und *L. fimbriata* sind dagegen eine sehr stabile Artengemeinschaft über ihr großes Verbreitungsgebiet in Afrika hinweg (z. B. Pearson & Mury 1979, Pearson & Juliano 1991, Werner 1993a, b). Betrachtet man Abb. 9, so fällt der große Unterschied der Mandibellängen zwischen diesen beiden Arten auf. Ihre Hutchinson-ratio (1.98; Tab. 6) würde daher noch eine Art mittelgroßer Mandibellänge „zulassen“. Tatsächlich tritt mit diesen beiden Arten häufig *Chaetodera regalis* auf, die eine Mandibellänge von 3.1—3.15 mm besitzt, aber interessanterweise eine etwas größere Körperlänge (ca. 16 mm) als *L. fimbriata* (ca. 14.5 mm) hat (Pearson & Mury 1979). Damit würde *C. regalis* ziemlich genau auf der Regressionsgeraden von Abb. 5 liegen, während *L. fimbriata* bei ähnlicher Körperlänge deutlich über dieser liegt. Inwieweit diese Mandibelverhältnisse tatsächlich eine Antwort auf interspezifische Konkurrenz darstellen, bleibt experimentell zu überprüfen. In diesem Zusammenhang sei auf die Anmerkungen zu *L. neglecta* und *H. nilotica* verwiesen.

Tabelle 5: Mandibelverhältnisse für Cicindelidenarten (n = Anzahl der vermessenen Individuen; Mittelwert der Mandibellänge) der Savannengewässer/Schlickufer.

	C. octoguttata	*M. flavidens*	*M. melancholica*
C. lutaria (n = 18; 1.35)	1.05	1.41	1.56
C. octoguttata (n = 20; 1.42)		1.34	1.49
M. flavidens (n = 14; 1.90)			1.11
M. melancholica (n = 20; 2.11)			—

Tabelle 6: Mandibelverhältnisse für Cicindelidenarten (n = Anzahl der vermessenen Individuen; Mittelwert der Mandibellänge) der Comoé-Sandbänke.

	H. nilotica	*L. fimbriata*
L. neglecta (n = 20; 1.85)	1.05	2.08
H. nilotica (n = 7; 1.94)		1.98
L. fimbriata (n = 10; 3.85)		—

Schlußfolgerungen

Die post hoc durchgeführte Analyse der Artengesellschaften unterschiedlicher Biotope an Hand von Mandibellängen der einzelnen Cicindelidenarten ersetzt nicht eine direkte Untersuchung mit vergleichenden oder experimentellen Ansätzen zur Überprüfung der Frage, ob diese Artengemeinschaften durch interspezifische Konkurrenz strukturiert sind. Trotzdem scheinen die Ergebnisse dieser wie auch anderer Arbeiten (Pearson & Mury 1979, Pearson 1980, Pearson & Juliano 1991, Ganeshaiah & Belavadi 1986, Schultz & Hadley 1987) starke Hinweise darauf zu geben, daß es sich im Falle von Sandlaufkäfern um eine Gilde handelt, die stark durch interspezifische

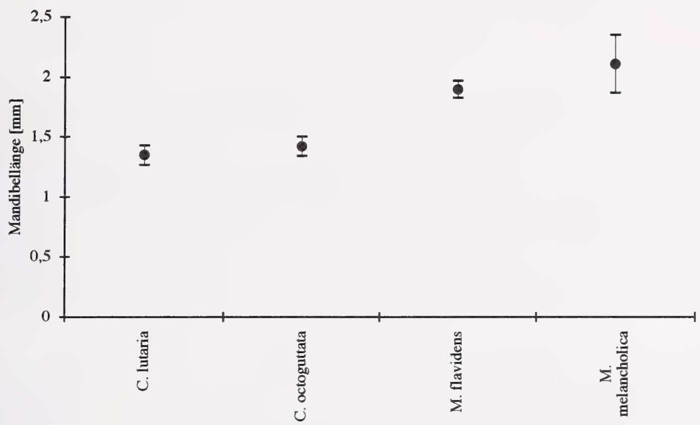

Abb. 8: Mittlere Mandibellängen (Punkte) und Standardabweichung (senkrechte Linien) für Cicindelidenarten der Savannengewässer/Schlickufer.

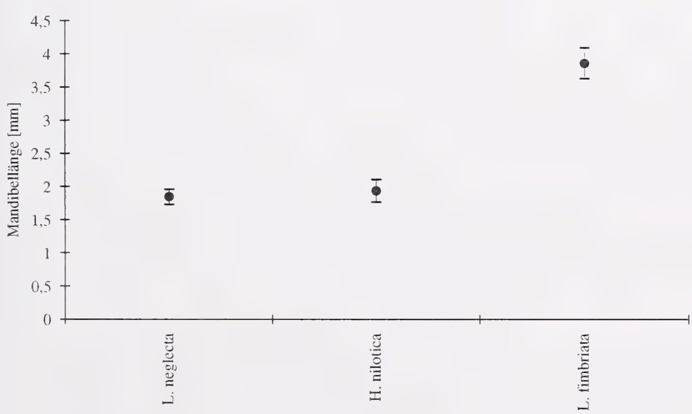

Abb. 9: Mittlere Mandibellängen (Punkte) und Standardabweichung (senkrechte Linien) für Cicindelidenarten der Comoé-Sandbänke.

Konkurrenz geprägt ist. Im Falle der vorliegenden Arbeit konnten nur die Mandibelverhältnisse quantitativ ausgewertet werden. Viele der wichtigen Parameter, wie z. B. Nahrung, Temperatur, Feuchtigkeitsansprüche, Larval- und Fortpflanzungsbiologie, sowie Prädatoren und Phänologie der jeweiligen Arten konnten nicht oder nur sehr ungenügend erfaßt werden (siehe Einleitung). Da es sich bei Cicindeliden um eine Gruppe handelt, die sowohl im natürlichen Lebensraum relativ leicht zu beobachten als auch experimentell zu manipulieren ist, wäre es wünschenswert, weitere Untersuchungen zu diesem Fragenkomplex an ihnen durchzuführen.

Außerdem sei darauf hingewiesen, daß Sandlaufkäfer im Bereich des Naturschutzes durch die meist spezialisierten Habitatsansprüche gut als Charakterarten zur Beurteilung von Schutzgebieten verwendet werden könnten. Eine ausführliche Darstellung dieses Aspekts findet sich bei Pearson & Cassola (1992).

Danksagung

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Zusammenfassung

Im Comoé-Nationalpark wurden 23 Cicindelidenarten auf einer Fläche von ca. 10 km^2 nachgewiesen. *Cylindera lutaria*, *Habrodera nilotica*, *Lophyridia fimbriata* und *Myriochile flavidens* waren von der Elfenbeinküste unbekannt. *Euryarthron planatoflavum* wird zum ersten Mal von Obervolta gemeldet. Eine Art (*Dromicoida elegantia*) war unbeschrieben (Werner 1995). Das Untersuchungsgebiet zeichnet sich durch einen außergewöhnlichen Artenreichtum aus, der durch das Habitatmosaik des Nationalparks begründet ist. Nur wenige Arten sind zoogeographisch auf die Elfenbeinküste und angrenzende Länder beschränkt, die meisten finden sich auch in Zentral- oder Ostafrika. Mögliche Gründe dafür werden angeführt. Sandlaufkäfer sind Mitglieder einer carnivoren Arthropodengilde, die in Habitaten mit hohen Temperaturen jagen. Durch die extremen Umweltbedingungen kommen nur wenige Organismen als potentielle Konkurrenten in Frage. Es kann davon ausgegangen werden, daß Cicindeliden, die syntop vorkommen, auf Grund einer sehr einheitlichen Lebensweise untereinander den stärksten Konkurrenzdruck ausüben. Nach Untersuchung der spezifischen Habitatpräferenzen der einzelnen Arten werden die Hutchinson-ratios der Mandibellängen sympatrischer Arten verglichen. Es zeigt sich, daß Arten, die im selben Mikrohabitat auftreten und eine vergleichbare Lebensweise haben, im allgemeinen den Voraussagen einer Merkmalsdivergenz folgen, während Arten, die zwar im gleichen Großbiotop leben, aber unterschiedliche Mikrohabitatsansprüche besitzen, häufig überlappende Mandibelverhältnisse aufweisen. Dies wird im Sinne von Strategien zur Konkurrenzverminderung diskutiert.

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Coleoptera Histeridae Hetaeriinae: description de nouveaux taxons, désignation de lectotypes et notes taxonomiques

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Abstract. New data are given for the beetle family Histeridae, subfamily Hetaeriinae. Two collecting methods were fairly productive: a flight interception trap and the flooding of whole antnests. A new cleaning technique was successfully tested for the preparation of genital structures; these are prepared in a basic solution of Genitase proteolytic enzyme. The female genitalia of 12 species of Hetaeriinae are described for the first time. New descriptive, distributional and/or ecological data are provided for 35 species, based on type-specimens, when possible. The following taxa are described as new: *Aristonister* n. gen.; *Colonides collegii guyanensis* n. subsp.; *Neocolonides howdeni* n. gen. n. sp.; *Troglosternus neoecitonis* n. sp. The following new combinations are proposed: *Aristomorphus borgmeieri, A. latipes, A. ogloblini, A. perversus, Aristonister sericeus, Hemicolonides parvulus; Latronister breyeri*. The following new synonymy is proposed: *Oudaimosister* Helava in Helava et al. 1985 = *Mesynodites* Reichardt, 1924. Lectotype and where the case, paralectotypes, are designated for the following species: *Aristomorphus borgmeieri, Aristonister sericeus, Cheilister sphaeroides, Clientister henrici, Colonides quadriglumis, Cossyphodister schwarzmaieri, Ecclisister bickhardti, Euxenister caroli, Hemicolonides parvulus, Parasynodites suturacava, Pelatetister pretiosus, Teratosoma amphiphilus, Troglosternus dasypus*. The genus *Hetaeriarchus* Reichensperger is considered as a nomen nudum.

Key words. Coleoptera, Histeridae, Hetaeriinae, Neotropics, myrmecophiles, termitophiles, new synonymies, new combinations, lectotype designations, new genera, new species.

Introduction

La récente révision générique de la sous-famille des Hetaeriinae, publiée par Helava et al. (1985) n'a malheureusement tenu compte ni des exemplaires-types des taxons révisés (Dégallier 1987), ni des taxons non représentés dans des collections nord-américaines. Ainsi, sur les 103 genres originellement inclus dans cette sous-famille, 26 n'ont pas été révisés. Par ailleurs, ces auteurs ont étudié les genitalia mâles de tous les genres révisés à l'exception de 18 d'entre-eux qui n'étaient connus que par des spécimens femelles. Enfin, aucune mention n'a été faite du possible rattachement de deux genres néotropicaux à la sous-famille des Chlamydopsinae, jusque-là composée exclusivement d'éléments indo-australiens (cf. Mazur 1984).

Le présent travail fournira des compléments aux descriptions (dont l'étude morphologique des genitalia femelles de plusieurs genres), désignera des lectotypes (et paralectotypes le cas échéant), proposera de nouvelles synonymies et combinaisons suggérées par l'étude de diverses collections (dont la principale est celle léguée par A. Reichensperger au Laboratoire d'Entomologie du Zoologisches Forschungsinstitut & Museum Alexander Koenig à Bonn, Allemagne) et enfin décrira quatre nouveaux taxons.

Matériel et Méthodes

Préparation des spécimens: Nous avons utilisé tout d'abord la méthode classique du ramollissage dans de l'eau froide ou chaude, suivi de l'extraction des genitalia puis de leur nettoyage après un séjour dans une solution de potasse à 10 %.

Une autre méthode, publiée récemment par notre ami histéridologue le Dr. P. Kanaar (1990), permet d'obtenir des résultats bien plus satisfaisants, sans dommages possibles, ni pour les pièces nettoyées, ni pour les outils entomologiques, le matériel optique ou les habits, tout en étant beaucoup moins dangereuse pour les yeux et les muqueuses. Les pièces à nettoyer sont placées dans une solution de Genitase (enzyme protéolytique bactérien, distribué par la société Biopraxis: Oegstgeest Pays-Bas) dans de l'eau additionnée de détergent et de carbonate de potassium (ce produit permet d'obtenir un pH optimum compris entre 9,5 et 10).

Terminologie: La terminologie morphologique utilisée est celle définie par Wenzel & Dybas (1940) et Helava et al. (1985). Toutefois, les longueurs du pronotum et des parties sternales sont mesurées le long de leur ligne médiane, sans tenir compte des avancées latérales. La longueur de la tête est comprise entre le vertex et le bord antérieur du labre.

A notre connaissance, la structure des génitalia femelles n'a encore jamais été décrite en détail chez les Hetaeriinae, ni utilisée pour classer les autres Histeridae.

Par analogie avec les pièces génitales mâles (cf. Fragoso 1985, pour une discussion sur cette analogie), les sclérites dorsaux et ventraux qui, au repos, forment deux tubes emboîtés et télescopés à l'intérieur du 7ème segment abdominal (= ovipositeur), seront respectivement dénommés tergite et sternite 8, tergite et sternite 9. Le lecteur intéressé par la nature exacte et les homologies des sclérites des segments VIII et IX des Coléoptères pourra consulter la synthèse réalisée par Deuve (1988).

Chez les femelles de la majorité des sous-familles d'Histeridae (Abraeinae, Chlamydopsinae, Dendrophilinae, Histerinae, Onthophilinae, Saprininae, Tribalinae, etc.), le sternite 8 forme une plaque plus ou moins sclérotisée, sétigère ou non apicalement et prolongée à sa base par des apodèmes paires. Le sternite 9 porte distalement des coxites et des styles bien individualisés et souvent sétigères, articulés à leur base sur des apodèmes (nommés valvifères par Yélamos 1989) dont le développement est variable (Bickhardt 1916–17: 13—14 et pl. 1 fig. 5; Dégallier 1981; Vomero 1973, 1977; Helava 1978: fig. 9). Entre les bases des coxites est visible un petit sclérite plus ou moins triangulaire et impair qui pourrait correspondre à un reste du segment 10.

Chez les Hetaeriinae, ces structures apparaissent modifiées, le plus souvent fortement raccourcies et quelquefois soudées entre elles. Les coxites sont toujours dépourvus de styles sub-apicaux et soudés à leurs apodèmes basaux.

Bien que seul l'aspect descriptif de ces structures nous intéressera ici, il est utile de signaler que ces modifications des genitalia femelles constituent des synapomorphies complémentaires permettant de définir sans hésitation la sous-famille des Hetaeriinae.

Abréviations (en partie selon Arnett, Jr. et al. 1986): AMIC, collection Antonio Martinez, Salta, Argentine; BMNH, The Natural History Museum, Londres, UK; CHND, collection de l'auteur, Paris, France; CHYG, collection d'Histérides, Yves Gomy, Fontenay sous Bois, France; CUBO, Carleton University, Department of Biology, Ottawa, Canada; DEIC, Institut für Pflanzenschutzforschung der Akademie der Landwirtschaftswissen der DDR, Abteilung Taxonomie der Insekten, Bereich Eberswalde Finow, DDR; FIOC, Instituto Oswaldo Cruz, Fundação Oswaldo Cruz-FIOCRUZ, Rio de Janeiro, Brésil; FMNH, Field Museum of Natural History, Chicago, USA; MACN, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires, Argentine; ZFMK, Zoologisches Forschungsinstitut & Museum Alexander Koenig, Bonn, RFA; ZMHB, Museum für Naturkunde der Humboldt-Universität, Berlin, RFA; L, longueur du pronotum sur la ligne médiane + longueur des élytres le long de la suture; l, largeur maximale des élytres pris ensemble; Lm (min.–max.) et lm (min.–max.), moyennes de L et l pour les spécimens mesurés (nombre N), accompagnées des valeurs mini- et maximales; Et. man., imp., étiquette manuscrite, imprimée; ex., exemplaire de sexe inconnu.

Résultats

Dans la liste qui suit, les genres sont classés selon l'ordre alphabétique et les espèces selon l'ordre chronologique de leurs descriptions originales.

Aemulister Reichensperger, 1938

Aemulister: Mazur 1984: 321; Helava et al. 1985: 337.

Aemulister borgmeieri Reichensperger, 1938

Aemulister borgmeieri: Mazur 1984: 321; Helava et al. 1985: 338.

Holotype (par désignation originale): un ♂ étiqueté: "Aemulister borgmeieri Reichensp." (man. à liséré noir) / "Eciton crassicorne 28 (ou "23" ?).12.35" / Campinas Goyaz, Brasil." / "Type! Reichensperger" (ét. rouge imp. avec liséré noir) / "MUSEUM KOENIG BONN". L = 2,2 mm; l = 1,8 mm. ZFMK.

Description complémentaire: Corps (excepté les pattes et antennes) brun rouge, ovale ou oblong, plus ou moins convexe, 0,8 fois aussi large que long. Longueur médiane du pronotum et des élytres: 2,2 mm. Largeur maximale: 1,8 mm. Tégument (entre la ponctuation) lisse et brillant.

Vertex sans tubercule. Front sans stries, sillons, rides ou carènes. Clypeus dans le même plan ou à peu près que le front et le labre, ce dernier plus ou moins quadrangulaire. Antennes insérées sous le rebord du front, en avant des yeux. Scape antennaire anguleusement dilaté. Funicule antennaire de sept articles. Massue antennaire en ovale plus ou moins allongé, en partie sclérotisée. Face externe des mandibules non modifiée à la base ou faiblement concave.

Pronotum à bord antérieur échancré, normalement convexe, non sculpté ni divisé en aires par des sillons, sans fossettes ni dépressions profondes ou incisions à la base, aux angles antérieurs sans expansion vers l'avant. Disque sans striation supplémentaire ni côtes. Base à surface non modifiée, régulièrement convexe, sans impression devant le scutellum.

Élytres sans striation supplémentaire entre les stries dorsales.

Longueur des sterna (pro-, méso-, méta- et st. abd. 1): 1,0 mm. Prosternum 0,4 fois aussi long que les sterna. Cavités antennaires plus ou moins nettes mais visibles en vue ventrale. Carène prosternale sans processus antérieur. Base du prosternum largement échancrée. Proépisternum avec une fossette ou une aire sétigère. Proépiméron sans fossette ou aire sétigère. Glande propleurale ou latéro-pronotale présente. Lobe prosternal présent (disposition histéromorphe), non subdivisé longitudinalement, à l'apex non modifié ni épaissi. Mésosternum 0,1 fois aussi long que les sterna, sans fossettes, s'enfonçant en pointe triangulaire dans la base du prosternum. Métasternum 0,35 fois aussi long que les sterna. Méso-métasterna sans bosse lisse. Limite méso-métasternale sans fossette. Premier sternite abdominal 0,15 fois aussi long que les sterna.

Tibias sans éperons.

Genitalia mâles (figs. 33—39): tergite 8 avec une strie antérieure transverse, sans prolongement ventro-postérieur; sternites 8 séparés, avec des disques mais sans soies apicales; tergite 9 avec des apodèmes ventraux, des guides internes pour l'édéage et des structures en crochets apicalement; tergite 10 présent, membraneux; édéage à base longue et paramères courts.

Matériel: Brésil: Campinas Goyaz, 3-1936 (Schwarzmaier), avec *Eciton crassicorne*, 1 ex. L = 2,25 mm; l = 1,8 mm. ZFMK

Aristomorphus Lewis, 1913

Aristomorphus: Mazur 1984: 303; Helava et al. 1985: 341.
Ecitonister: Reichensperger, 1923a: 326, nouvelle synonymie.
Ecitonister: Mazur 1984: 310 (partim.).

Parmi tous les genres d'Hetaeriinae connus, seul *Ecitonister* Reichensperger possède le lobe prosternal excavé antérieurement. Nous avons eu la surprise de retrouver une structure similaire chez l'holotype de *Aristomorphus rutilus* Lewis, 1913.

La combinaison de caractères qui caractérise ce genre est:

— surface dorsale presque plane dans sa moitié antérieure et bombée vers l'arrière;

— fronto-clypeus avec trois élévations à ponctuation sétigère et une zone médiane concave et lisse;

— présence de touffes de trichomes (associées ou non à des fossettes visibles = orifices glandulaires?) près des angles postérieurs du pronotum, sur la face dorsale, sur les hypomères, en ligne verticale sur les flancs de la carène prosternale ou sur la limite méso-métasternale;

— métasternum extrêmement allongé, 1er sternite abdominal court.

Parmi les cinq espèces décrites dans le genre *Ecitonister* Reichensperger (Mazur, 1984: 310; Helava et al. 1985: 282), quatre sont sans aucun doute congénériques. La cinquième, utilisée par Helava et al. (1985: 280) comme représentative du genre, ne peut plus en faire partie, pour les raisons exposées plus loin.

L'étude d'exemplaires authentiques des espèces en cause permet d'établir le catalogue des espèces du genre *Aristomorphus* de la manière suivante:

— *Aristomorphus rutilus* Lewis, 1913;

— *Aristomorphus perversus* (Reichensperger, 1923a: 327), nouvelle combinaison;

— *Aristomorphus borgmeieri* (Reichensperger, 1931: 268), nouvelle combinaison;

— *Aristomorphus ogloblini* (Bruch, 1933: 34), nouvelle combinaison;

— *Aristomorphus latipes* (Reichensperger, 1933: 305), nouvelle combinaison;

— *Ecitonister sericeus* Borgmeier, 1948 devient l'espèce-type d'un genre nouveau décrit plus loin.

Aristomorphus rutilus Lewis, 1913

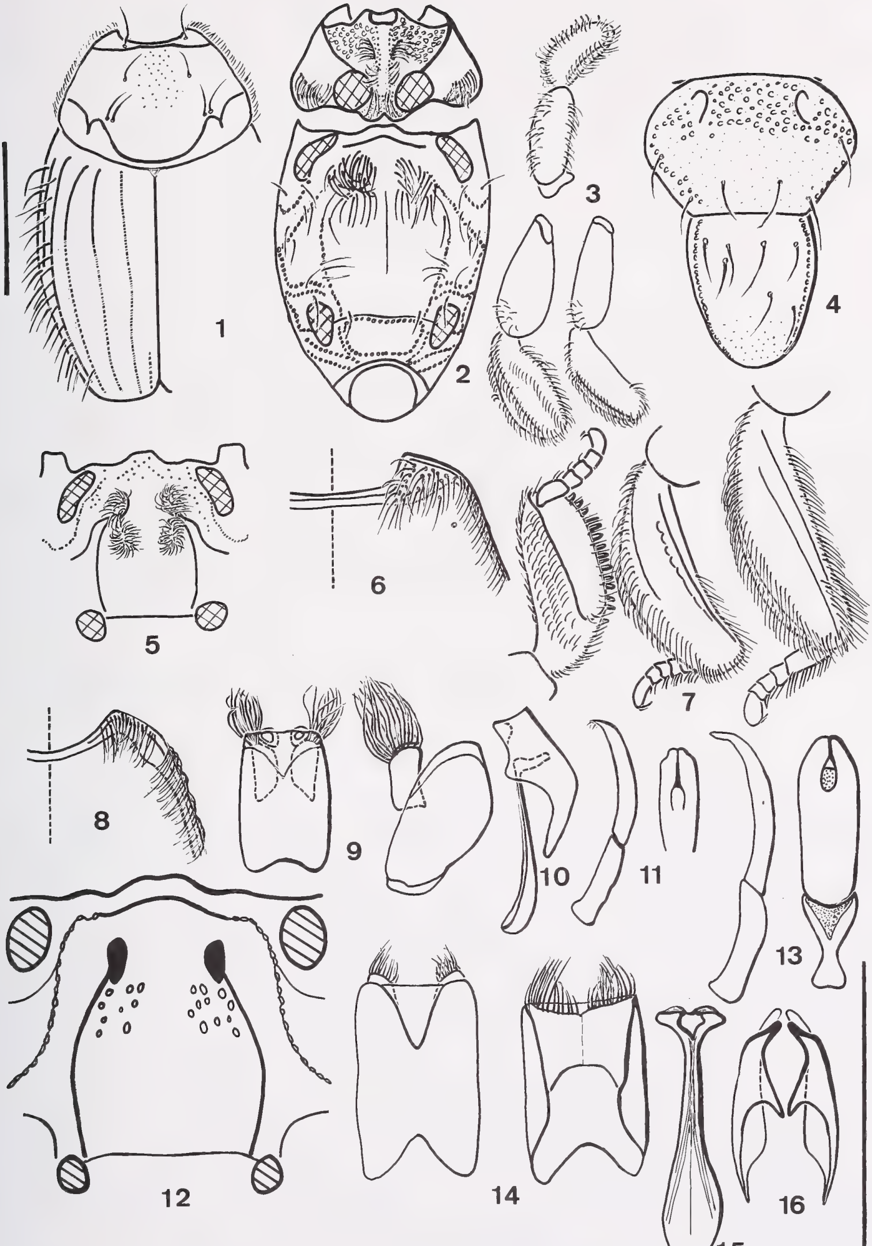
A. rutilus: Mazur 1984: 303.
A. rutilis (err. typogr.): Helava et al. 1985: 342.

Holotype (par monotypie): une ♀ étiquetée: "Type" (ét. ronde à bordure rouge) / "Corcovado, Rio de Janeiro G. E. Bryant. 14. V. 1912" (ét. blanche imp. avec une ligne verte au recto) "1913 43" (au verso) / "Aristomorphus rutilus Lewis Type" (ét. man.) / "SYNTYPE" (ét. ronde à bordure bleue). L = 2,4 mm; l = 1,6 mm. BMNH.

Redescription: Forme en ovale allongé, peu convexe (fig. 1); surface lisse et brillante, avec de longues soies éparses, alignées le long de certaines stries ou regroupées en aires.

Tête 1,1 fois aussi large que longue, non carénée latéralement; front dépourvu de strie mais montrant, de chaque côté au-dessus et en avant des yeux, une aire convexe densément ponctuée et longuement sétigère; clypeus renflé avec une aire médiane également à ponctuation sétigère; vertex et front concaves et lisses au milieu; mandibules à pointe très acérée, non modifiées à leur base; labre quadrangulaire, 2 fois aussi large que long, surface lisse, marge apicale avec une pointe au milieu, une (ou deux) forte(s) soie(s) à chaque angle basalement; massue antennaire ovale, sclérotisée dorsalement, ventralement et sur sa face externe.

Figs 1—16; figs 1—4: *Aristomorphus rutilus* — 1, vue dorsale, 2, vue ventrale, 3, pattes antérieure, médiane et postérieure (vue ventrale), 4, pygidia; figs. 5—7: *Aristomorphus perversus* — 5, méso- métasternum, 6, angle antérieur du pronotum, 7, protibia (vue dorsale), méso- et métatibia (vues ventrales); figs. 8—12: *Aristomorphus borgmeieri* — 8, angle antérieur du pronotum, 9, tergite et sternite 8 du mâle (vues dorsale et de profil), 10, tergite et sternite 9 du mâle (vue de profil), 11, édéage (vue latérale et apex en vue ventrale), 12, méso-métasternum; figs. 13—16: *Aristomorphus ogloblini* — 13, édéage (vues latérale et dorsale), 14, tergite et sternite 8 du mâle (vues dorsale et ventrale), 15, sternite 9 du mâle (vue dorsale), 16, tergite 9 du mâle (vue ventrale). Echelles 1 mm: à gauche pour les figs. 1—3, 5; à droite pour les autres figs.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Pronotum 1,5 fois aussi large que long; marges latérales presque droites sur leurs $^{3}/_{4}$ basaux, convergentes vers l'avant; angles antérieurs tronqués obliquement; échancrure antérieure large et arquée; base en demi-cercle régulier, angles arrondis; surface peu convexe sur le disque et le long des bords latéraux, deux légères dépressions en arrière des yeux, deux autres plus prononcées en dedans des angles postérieurs, chacune de ces dernières prolongée d'un sillon vers l'avant et l'extérieur; ponctuation peu dense et extrêmement fine, excepté une bande médiane de quelques points plus gros sur le tiers antérieur; striation comme dans la description originale (strie marginale entière, strie latérale réduite à sa portion apicale, une strie arquée reliant les fossettes basales); une rangée de soies dressées à l'extérieur de la strie marginale latéralement, cette dernière prolongée le long de la base par des points alignés; de longues soies isolées (ou tout au moins les gros points qui en marquent l'implantation) sont disposées symétriquement, une première sur la strie marginale au niveau de l'oeil, une autre environ au milieu de la longueur et une troisième au niveau du $^{1}/_{5}$e basal, ces trois soies formant un triangle très étiré dont le sommet, externe, est formé par le deuxième point sétigère; hypomère avec deux rangées basales et obliques de soies courtes.

Élytres plans ou un peu concaves en avant, convexes le long de la suture et en arrière, déclives et arrondis latéralement; angles antérieurs externes très aigus et proéminents, bords postérieurs arrondis, très rétrécis; ponctuation comme sur le pronotum, peu dense et extrêmement fine, sétigère au moins près des bords, plus forte et alignée le long des stries, éparse sur le $^{1}/_{4}$ postérieur; stries légèrement carèniformes, intervalles les séparant quasiment plans, de largeurs inégales; 4 stries dorsales entières (sauf la 1ère brièvement interrompue en arrière), sinuées, les deux 1ères (externes) recourbées vers la suture à chacune de leurs extrémités; suturale représentée par un court appendice apical et une ligne de points espacés vers l'avant; strie subhumérale (interne?) basale, atteignant le milieu; deux stries épipleurales; épipleurale externe visible du dessus à la base de l'élytre (elle pourrait être interprétée comme une subhumérale externe), descendant sur l'épipleure, puis remontant perpendiculairement pour atteindre le $^{1}/_{3}$ postérieur de l'élytre; épipleurale interne, formée de points alignés, atteignant à peine le milieu, raccourcie également en avant et représentée par un court appendice de strie à l'apex.

Propygidium 1,6 fois aussi large que long, peu convexe, la moitié basale et les bords latéraux avec des gros points dont certains portent des soies fortes; deux petites stries en croissants ouverts vers l'extérieur divisent la base approximativement en trois parties (fig. 4).

Pygidium 0,8 fois aussi large que long, bombé; ponctuation apicale forte et éparse, une strie ponctuée longe chaque côté (fig. 4).

Sterna de structure très particulière, en réalité difficile à décrire avec des mots (v. fig. 2). Prosternum comprimé latéralement; carène dépourvue de stries; base coupée droite, avec une petite incision triangulaire et presque toute la partie située entre les procoxae creusée pour recevoir une large avancée du mésosternum; apex tronqué droit, formant la limite postérieure d'une cavité occupant la partie médiane du lobe prosternal; ce dernier séparé des alae par une suture; stries latérales courtes, très "ascendantes", chacune garnie d'une forte soie; stries latérales marginales courtes, longées de soies fortes, se terminant en avant dans une fossette (orifice glandulaire ?); alae ornées d'une vingtaine de très gros points; bords de la carène ponctués sur leur moitié apicale, lisses basalement; médialement par rapport à chaque angle postérieur s'ouvre une cavité profonde (orifice glandulaire ?) dont le "toit" est formé d'une rangée de fortes soies contiguës. Mésosternum en avancée largement arquée, le rebord en bourrelet; une fossette profonde de chaque côté, surmontée de 2 touffes de poils; strie marginale entière, peu nette, arquée; mesocoxae très écartées, déportées sur les côtés. Métasternum très long; stries latérales internes entières, convergentes vers l'arrière, entre les metacoxae; stries latérales externes formées de gros points alignés, ainsi que les stries postcoxales, ces dernières légèrement récurrentes. Premier sternite abdominal entouré apicalement d'une ligne de points. Longueurs relatives (rapportées à la longueur totale des sterna) du pro-, méso-, métasternum et 1er sternite abd. respectivement égales à 0,3; O,16; 0,4; 0,12.

Pattes (fig. 3) de longueur modérée, antérieures et médianes avec des soies recourbées, disposées en rangées, postérieures à fémurs presque inermes; ponctuation régulière, très dense; tibias aplatis, bord externe non anguleux, garni de denticules.

Genitalia mâles inconnus; genitalia femelles non étudiés.

Aristomorphus perversus (Reichensperger, 1923a)

Ecitonister perversus: Mazur 1984: 311; Helava et al. 1985: 282.

Holotype (par monotypie): un ex. étiqueté: "Ecitonister perversus n. Reichensp." (man. à cadre noir) / "TYPUS" (ét. rouge imp.)/ "St. Catarina Blumenau 22 XII" (imp. et man.) / "Eciton (imp.) caecum (man.)" (ét. à cadre noir) / "Coll. Reichensperger" (imp.). ZFMK. L = 2,1 mm; l = 1,5 mm.

Il est fort probable que cette espèce ne représente qu'une variété de la précédente (figs. 5—7). Bien que nous n'ayons pu comparer directement les types, les seules différences que nous avons pu relever concernent la striation moins développée et la ponctuation plus discrète chez *A. perversus* qui ne montre par ailleurs ni striation ni ponctuation particulière à la base du propygidium. Seul du matériel complémentaire en provenance de chacune des localités-types permettrait d'établir son statut avec certitude.

Aristomorphus borgmeieri (Reichensperger, 1931)

Ecitonister borgmeieri: Mazur 1984: 310; Helava et al. 1985: 282.

Lectotype (présente désignation): une ♀ étiquetée: "Ecitonister borgmeieri n. Reichensperger" (man. à cadre noir) / "Eciton praedator" (imp. à cadre noir) / "Type ! Reichensperger" (ét. rouge imp.). ZFMK. L = 1,8 mm; l = 1,3 mm.

Cette espèce se distingue des précédentes et de celle qui suit principalement par sa taille inférieure, le dessin de la strie pronotale latérale dans les angles antérieurs (fig. 8) et les ponctuation et chétotaxie des sterna (fig. 12). Les genitalia mâles (figs. 9—11) combinent la présence d'une strie apicale sur le tergite 8, des disques simples et des soies à l'apex de chaque sternite 8, le tergite 9 avec des apodèmes ventraux-postérieurs et des guides internes de l'édéage; ce dernier se compose d'une base longue et de paramères longs; le sternite 9 n'est pas particulièrement modifié.

Matériel: Brésil: Altamira-Maraba km 18, Para, 10-23/09/85, piège d'interception, 2 ex., 1 ♂; Tucurui, Para, 27/10-9/11/85, piège d'interception, 1 ♂, CHND.

Aristomorphus ogloblini (Bruch, 1933)

Ecitonister ogloblini: Mazur 1984: 310; Helava et al. 1985: 282.

Holotype (désignation originale): 1 ♂ étiqueté: "Ecitonister Ogloblini Bruch typus (man.) C. BRUCH DETERM. (imp.)" (ét. à cadre noir)/ "con Eciton (L.) coecum" (man.)/ "Typus" (ét. rouge man.)/ "Est. Exp. Loreto (Misiones-Arg.) Dr. A. A. Ogloblin (recto imp.) 21. iii. 1932 (verso man.)". L = 2,5 mm; l = 1,8 mm. MACN.

Les figs. 13 à 20 montrent des structures qui peuvent aider à différencier cette espèce des précédentes. Contrairement à *A. borgmeieri*, on n'observe pas de disques apicaux sur les sternites 8 du mâle mais seulement des soies.

Matériel. Brésil: Bella Vista, Goiás, 28/12/1934 (Schwarzmaier), avec *Eciton caecum*, 1 ex., ZFMK. Lm = 2,4 mm; lm = 1,8 mm (N = 2).

Aristomorphus latipes (Reichensperger, 1933)

Ecitonister latipes: Mazur 1984: 310; Helava et al. 1985: 282.

Holotype (par monotypie): un ex. étiqueté: "Ecitonister latipes n. sp. Reichensp" (man. à cadre noir) / "Campo Bello Est. Rio coll. Reichensperger" (imp. à cadre noir) / "Eciton praedator" (imp. à cadre noir) / "Type! Reichensperger" (ét. rouge imp. à cadre noir). ZFMK.

De par sa petite taille, l'absence de strie pronotale basale et de fossettes méso-métasternales (fig. 21—22), la présence d'une large dent sur ses fémurs antérieurs et des paramères longs creusés en gouttière ventralement (fig. 32), *A. latipes* pourrait constituer un sous-genre distinct. La strie pronotale latérale est ici tout à fait parallèle aux angles antérieurs (fig. 23).

En outre, cette espèce semble être la seule dont la forme du pygidium est différente suivant le sexe, plus pointue chez la femelle (figs. 24—25).

Matériel: Brésil: Itatiaya, Etat de Rio de Janeiro, avec *Eciton praedator* (Zikan), 3 ex. dont 1 ♂ et 1 ♀, ZFMK; Campo Bello, Etat de Rio de Janeiro, avec *Eciton praedator* (coll. Reichensperger), 1 ex., MACN. Lm = 1,5 (1,4—1,5) mm; lm = 1,3 (1,2—1,3) mm (N = 4).

Aristonister, nouveau genre

Ecitonister: Helava et al. 1985: 280.

Espèce-type: *Ecitonister sericeus* Borgmeier, 1948

Ce genre se distingue de *Aristomorphus* par la combinaison de caractères suivante: face externe des mandibules incisées à la base; deux stries pronotales latérales dont l'interne est très éloignée du bord; proépisterne et proépimère dépourvus de fossettes ou aires sétigères; apex du lobe prosternal non excavé; stries métasternales latérales internes très rapprochées du milieu en avant, sinuées pour rejoindre les angles postérieurs; genitalia mâles: sternites 8 non sétigères à l'apex, édéage à pièce basale longue et paramères courts.

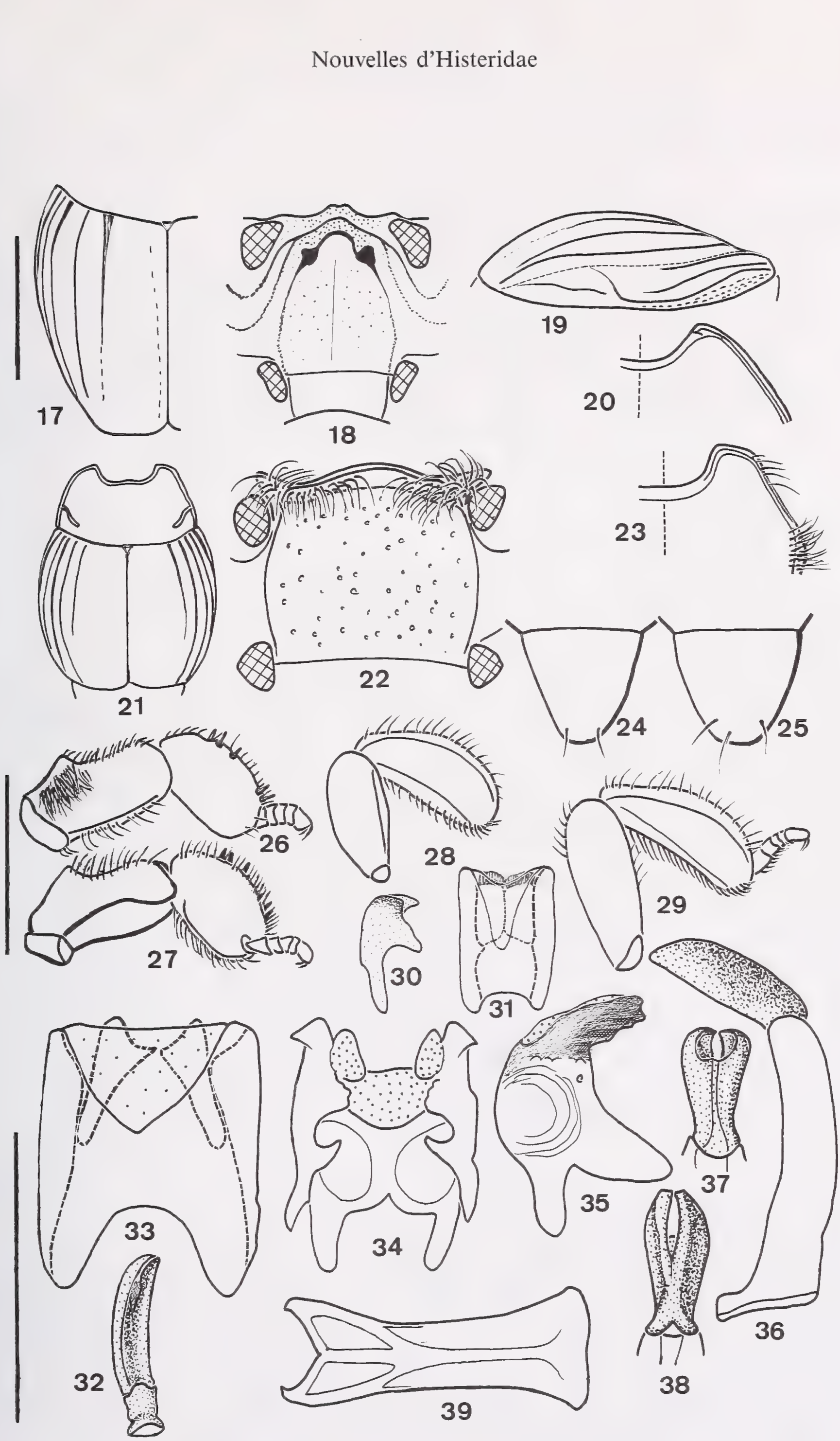
Aristonister sericeus (Borgmeier, 1948), nouvelle combinaison

Ecitonister sericeus: Mazur 1984: 311; Helava et al. 1985: 282.

Lectotype (présente désignation): un ♂ étiqueté: "Ecitonister sericeus Borgm." (man. à cadre noir) / "b. E. pseudops Trinidade Bras. 21.9.36" (man. à cadre noir) / "A. Reichensperger 1949"' (imp. et man.). L = 2,2; l = 1,7 mm. ZFMK. Paralectotype (présente désignation): un ex. étiqueté: "Campinas, Goiás Schwarzmaier" (imp.) "16.XII.1938 E. pseudops" (man.) / "Cotypus" (rouge imp.) / "SEM" (jaune imp.) / "Ecitonister sericeus Borg. Type" (man.) "det. Borgmeier" (imp. à cadre noir). FMNH; les données relatives à ce specimen nous ont été aimablement fournies par le Dr. A. F. Newton, Jr. (FMNH).

Bien que ces deux specimens soient sans nul doute des syntypes, il faut cependant noter que les dates portées par les étiquettes et citées ci-dessus ne correspondent pas exactement aux dates publiées par le descripteur: 26/09/1936 et 16/11/1938, respectivement.

Figs 17—39; figs 17—20: *Aristomorphus ogloblini* — 17, élytre gauche en vue dorsale, 18, méso-métasternum, 19, élytre droit vu de profil (la ligne pointillée délimite l'épipleure), 20, angle antérieur du pronotum; figs. 21—32: *Aristomorphus latipes* — 21, vue dorsale, 22, méso-métasternum, 23, angle antérieur pronotal, 24, pygidium de la femelle, 25, idem, mâle, 26, patte antérieure en vue ventrale, 27, idem, vue dorsale, 28, patte médiane en vue ventrale, 29, patte postérieure en vue ventrale, 30, tergite 9 du mâle vu de profil, 31, tergite et sternite 8 du mâle en vue dorsale, 32, édéage en vue latéro-ventrale gauche; figs. 33—39: *Aemulister borgmeieri* — 33, tergite et sternite 8 du mâle en vue dorsale, 34, tergite 9 du mâle en vue ventrale, 35, idem, profil gauche, 36, édéage, profil droit, 37, idem, paramères en vue dorsale, 38, idem, vue ventrale, 39, sternite 9 du mâle en vue dorsale. Echelles 1 mm: en haut pour les figs. 17—19, 21, au milieu pour les figs. 33—39 et en bas pour les autres figs.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Cheilister Reichensperger, 1924

Cheilister: Mazur 1984: 300; Helava et al. 1985: 319.

Cheilister sphaeroides Reichensperger, 1938

C. sphaeroides: Mazur 1984: 300; Helava et al. 1985: 321.

Lectotype (présente désignation): un ex. étiqueté: "Cheilister sphaeroides Reichensp." (man. à cadre noir) / "Hamburg-Farm Costa Rica Nevermann (imp.) 8. XI 8a (man.)" (ét. à cadre noir) / "Type! 2 Reichensperger" (ét. rouge imp.) / "E. (Acamatus) pilosum. c. Reichensperger" (imp. à cadre noir). ZFMK. Paralectotype (présente désignation): un ex. étiqueté: "Cheilister sphaeroides Reichensp." (man. à cadre noir) / "Hamburg-Farm Costa Rica Nevermann (imp.) 8. XI 8a (man.)" (ét. à cadre noir) / "Paratype! Reichensperger" (ét. rouge imp. à cadre noir) / "E. (Acamatus) pilosum. c. Reichensperger" (imp. à cadre noir) / "MUSEUM KOENIG BONN" (ét. jaune imp.). ZFMK.

Clientister Reichensperger, 1935

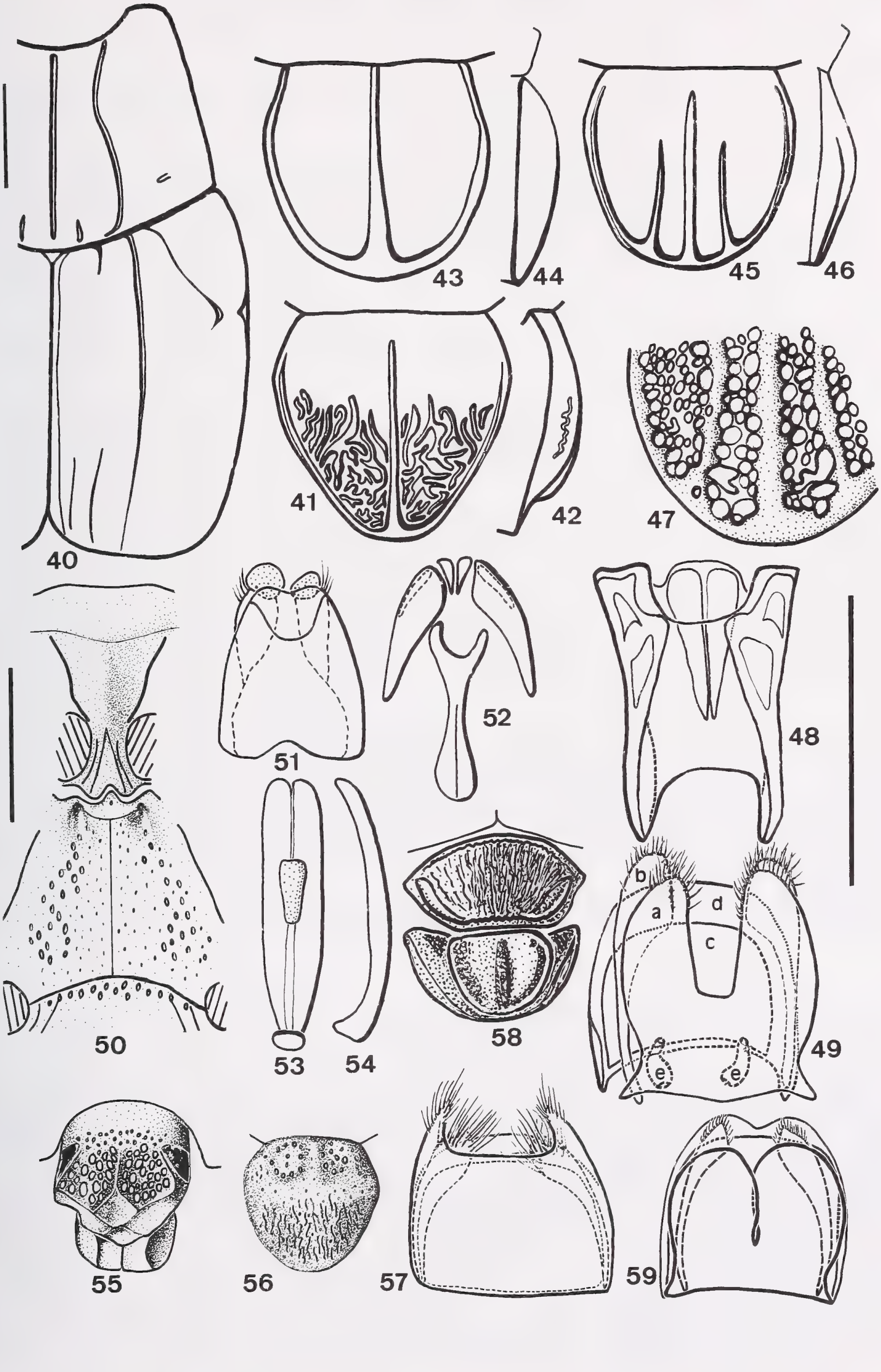
Clientister: Mazur 1984: 311; Helava et al. 1985: 324.

Clientister henrici Reichensperger, 1935

C. henrici: Mazur 1984: 311; Helava et al. 1985: 326.

Lectotype (présente désignation): un ex. étiqueté: "Clientister henrici n. g. n. sp. Reichensp." (man. à cadre noir) / "San Jose Costa Rica H. Schmidt" (imp.) / "Eciton burchelli (imp.) 9.1932 (man.)" (ét. à cadre noir) / "Type! Reichensperger" (ét. rouge imp. à cadre noir). ZFMK. Paralectotypes (présentes désignations): un ex. étiqueté: "Clientister henrici Reichensp." (man. à cadre noir) / "San Jose Costa Rica H. Schmidt" (imp.) / "Eciton burchelli (imp.) 9.1934 (man.)" (ét. à cadre noir) / "Paratype! Reichensperger" (ét. rouge imp. à cadre noir). ZFMK; un ex. étiqueté: "Clientister henrici Reichensp." (man. à cadre noir) / "San Jose Costa Rica H. Schmidt" (imp.) / "Eciton burchelli (imp.) IX.33 (man.)" (ét. à cadre noir) / "Paratype! Reichensperger" (ét. rouge imp. à cadre noir). ZFMK; un ex. étiqueté: "Clientister henrici Reichensp." (man. à cadre noir) / "San Jose Costa Rica H. Schmidt" (imp.) / "Eciton burchelli (imp.) . . . 34. (man.)" (ét. à cadre noir) / "Paratype! Reichensperger" (ét. rouge imp. à cadre noir). ZFMK; un ex. étiqueté: "Clientister henrici Reichensp." (man. à cadre noir) / "San Jose Costa Rica H. Schmidt" (imp.) / "Eciton burchelli (imp.) IV. 33 (man.)" (ét. à cadre noir) / "Co (man.) Type! Reichensperger" (ét. rouge imp. à cadre noir). ZFMK; un ex. étiqueté: "Clientister henrici Reichensp." (man. à cadre noir) / "Costa Rica F. Nevermann 26.III. 1934" (ét. verte imp. et man.) / "Hamburg Farm Reventazon Ebene Limon" (ét. verte imp.) / "Eciton burchelli" (imp. à cadre noir) / "Paratype! Reichensperger" (ét. rouge imp. à cadre noir). ZFMK; un ex. cité par Gaedicke (1984: 460): "Costa Rica, San José, 11. 1933, an *Eciton burchelli*, leg. H. Schmidt.", DEIC.

Figs 40—59; figs 40—42: *Colonides collegii guyanensis* n. subsp. — 40, moitié droite du pronotum et des élytres, 41, pygidium de la femelle, 42, idem, profil gauche; figs.43—47: *Colonides c. collegii* — 43, pygidium du mâle, 44, idem, profil gauche, 45, pygidium de la femelle, 46, idem, profil gauche, 47, idem, détail de l'apex; figs. 48—49: *Colonides quadriglumis* — 48, tergite 9 du mâle en vue ventrale, 49, genitalia femelles en vue ventrale avec a, sternite 8, b, sternite 9, c, tergite 9, d, tergite 8 et e deux sclérites génitaux; figs. 50—57: *Procolonides bruchi* — 50, sterna (ex. coll. T. Borgmeier, FIOC), 51, tergite et sternite 8 du mâle (topotype, BMNH) en vue dorsale, 52, tergite et sternite 9 du mâle (ex. topotype, BMNH) en vue dorsale, 53, édéage (ex. coll. T. Borgmeier, FIOC) en vue ventrale, 54, idem, profil droit, 55, tête (ex. coll. T. Borgmeier, FIOC), 56, pygidium (ex. topotype, ZFMK), 57, genitalia femelles en vue ventrale (ex. coll. C. Bruch, MACN); figs. 58—59: *Neocolonides howdeni* n. gen. n. sp. — 58, pygidia, 59, genitalia femelles en vue ventrale. Echelles 1 mm: à gauche en haut pour la fig. 40; à gauche au milieu pour les figs. 41—46, 58; à droite pour les autres figs.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Matériel: Costa Rica: San José (H. Schmidt) avec *Eciton burchelli*, 2 ex., CHND. L = 1,6 mm; l = 1,5 mm.

Colonides Schmidt, 1889

Colonides: Mazur 1984: 305; Helava et al. 1985: 198.
Xylostega: Mazur 1984: 305; Helava et al. 1985: 200.

Helava et al. (1985) ont regroupé dans un même ensemble, avec cependant quelques réserves, les genres suivants: *Colonides* (incluant le genre *Xylostega* Reichensperger qui, pour nous, en est synonyme), *Procolonides* et *Hemicolonides* sensu Helava (taxon révisé plus loin).

En 1935 (p. 204), Reichensperger mettait son genre *Xylostega* en synonymie avec *Colonides* mais sans préciser quelles étaient les "einiger kleiner Unterschiede" [quelques petites différences] subsistant entre ces deux genres. Les caractères invoqués par Helava et al. (1985) pour différencier *Xylostega* de *Colonides* sont assez subjectifs. Ils ne pourraient tout au plus servir qu'à séparer des sous-genres. Ils sont distribués chez les différentes espèces de la manière suivante:

— *C. drakei* ne semble pas posséder de strie élytrale dorsale médiane plus forte que les autres. Par contre, *Colonides collegii* (Reichensperger) possède cette carène dans un état intermédiaire entre celui présent chez *Colonides hubrichi* Bruch et chez *C. quadriglumis* (Reichensperger).

— les stries prosternales sont très rapprochées mais la strie mésosternale postérieure ("additionnelle") n'existe ni chez *C. quadriglumis* ni chez *C. collegii*;

— le caractère plus ou moins relevé des bords du pronotum et des élytres nous semble difficile à apprécier.

En conclusion, s'il fallait séparer ces espèces selon deux groupes, nous le ferions donc plutôt de la manière suivante: gr. 1, *C. collegii*; gr. 2, *C. hubrichi, C. quadriglumis, C. drakei* (?).

Contrairement à ce qui est indiqué dans le cladogramme et les schémas de genitalia mâles (Helava et al. 1985: figs. 5, 86 et 90), nous avons observé un 10eme tergite nettement sclérotisé chez toutes les espèces de *Colonides* (v. fig. 48: *C. quadriglumis*).

Chez toutes les femelles des espèces de *Colonides*, les genitalia, une fois dévaginés, forment un tube (= ovipositeur auct.) court avec, dorsoventralement (de bas en haut sur la fig. 49), une plaque impaire inerme (tergite 8: d sur la fig.), l'orifice anal, une seconde plaque impaire inerme (tergite 9: c), une paire de coxites sétigères mais dépourvus de style et leurs apodèmes proximaux (sternite 9: b), l'orifice génital flanqué d'une paire de petits sclérites (e; = vestiges du segment abd. 10 ?), une plaque impaire portant distalement et de chaque côté un prolongement sétigère (sternite 8: a).

Le dimorphisme sexuel relatif à la disposition des carènes et à la ponctuation pygidiale (fig. 41—47) se retrouve dans tout le genre.

Colonides drakei Schmidt, 1889

C. drakei: Mazur 1984: 305; Helava et al. 1985: 200.

Holotype: non retrouvé.
La description originale de ce taxon s'applique exactement aux spécimens de *C. quadriglumis* étudiés. Les caractères principaux en sont: stries élytrales dorsales complètes, bordure apicale du propygidium ondulée, méso-métasternum et premier sternite abdominal strigueux.

En l'absence de matériel authentique de cette espèce, nous nous bornerons à la rattacher au groupe formé de *C. hubrichi* et *C. quadriglumis*.

Colonides collegii (Reichensperger, 1923a)

C. collegii: Mazur 1984: 305.
Xylostega collegii: Reichensperger 1924: 120; Helava et al. 1985: 202.

Holotype (par monotypie: dans la description originale, Reichensperger ne désigne pas d'holotype et ne précise pas le nombre de spécimens en sa possession, contrairement à ce qu'il fait pour d'autres espèces décrites dans le même article; il emploie cependant l'expression "Das Tier erweckt . . ." qui nous permet de supposer l'existence d'un seul spécimen!): un ♂ étiqueté: "St. Catarina Blumenau" (ét. imp.) / "Eciton burchelli" (ét. manuscrite) / "Xylostega n. collegii n. sp. Reichensp." (ét. man.) / "Xylostega R. = Colonides Schmidt" (ét. man.) / "coll. Reichensperger" (ét. imp.) / "TYPUS" (ét. imp. en rouge). L = 4,2 mm; l = 3,5 mm. ZFMK.

Il est notable que la strie élytrale dorsale médiane forme une côte plus élevée que les autres stries, quoique à un degré moindre que chez *C. hubrichi.*

Cette espèce possède une répartition très étendue, se superposant à celle de son hôte *Eciton burchelli* (Westwood). On la rencontre du Costa Rica au sud du Brésil, en passant par les Guyanes.

Matériel: Costa Rica: Hamburg-Farm Reventazon, Ebene Limon, 1-11-34 (F. Nevermann), 1 ♀; idem, 27/11/1934,1 ♂, FMNH, idem, 1 ♂, ZFMK. Brésil: Marambo, Rio de Janeiro, 03/1925 (J. F. Zikan), 1 ♂, 1 ♀, 1 ex., ZFMK; Itatiaya, idem, 6/04/25, 1 ♀, FIOC; Est. Rio de Janeiro, 1 ♀, MACN. Lm = 4,15 (3,9—4,3) mm; lm = 3,5 (3,4—3,6) mm (N = 5).

Colonides collegii guyanensis, nouvelle sous-espèce

Holotype: une ♀: Saül (3°37,8'N; 53°11,9'W), Guyane française, 3/08/1978, dans colonne migrante d' Eciton burchelli, 18—20 h. L = 4,8 mm; l = 4,0 mm. CHND. Paratypes: deux ♀: même provenance. CHND. Lm = 4,8 (4,8—4,9) mm; lm = 3,8 (3,7—4,0) mm (N = 3).

Cette sous-espèce se distingue de l'espèce nominale par les caractères suivants (femelles):

— stries élytrales dorsales 1 et 2 (les plus externes) absentes (fig. 40);

— 4eme strie dorsale réduite à un court appendice basal et à seulement 1/3 de la longueur de l'élytre apicalement (fig. 40). Le raccourcissement de cette strie n'a été observé chez aucune autre espèce du genre;

— pygidium à ponctuation très forte et confluente dans sa moitié apicale, rendant indistinctes les carènes latérales (figs. 41—42).

L'abréviation maximale des stries élytrales et la confluence extrême de la ponctuation pygidiale, observées chez ces exemplaires de Guyane française, représentent des différences nettement plus prononcées que les variations individuelles observées chez l'espèce nominale.

Comme le suggère la répartition des différentes sous-espèces d'*Eciton burchelli* présentée par Watkins II (1976), *C. c. guyanensis* pourrait représenter une différenciation parallèle à celle de l'hôte *E. b. cupiens* Santschi qui habite les Guyanes et le versant nord du bassin amazonien tandis que les *C. collegii* typiques se récoltent avec *E. burchelli s. str.* du sud brésilien. En Amérique centrale, l'hôte pourrait être *E. b. foreli* Mayr. Un *C. collegii* mâle provenant du Costa Rica n'exhibait cependant aucune différence notable par rapport à la forme typique.

Colonides hubrichi Bruch, 1923

C. hubrichi: Reichensperger 1924: 121; Bruch 1937: 129; Mazur 1984: 305; Helava et al. 1985: 200.
Xylostega hubrichi: Bruch 1929: 434.

Holotype (par désignation originale): une ♀ étiquetée: "Alta Gracia, Córdoba 4. XII. 921" (ét. man.) / "Typus" (ét.verte imp.) / "Corriendo con Eciton dulcius Jujuyensis For." (ét. man.). L = 3,5 mm; l = 2,9 mm. MACN.

C. hubrichi semble être spécifiquement associé à *Eciton d. dulcius* Forel du sud du Brésil et du nord de l'Argentine (Watkins II, 1976). Il serait intéressant de rechercher cet histéride chez *E. d. crassinode* Borgmeier, sous-espèce du Costa Rica et du Panama.

Matériel: Brésil: Campinas, Goiás, 27/10/33 (T. Borgmeier), 2 ♂, 1 ♀, ZFMK; idem, 1 ♂, FIOC; idem, 1 ♂, FMNH, idem (Schwarzmaier), 2 ♂, 4 ♀, CUBO; idem, 1 ♂, avec *Eciton dulcius*, AMIC. Argentine: Hersilia, Prov. Santa Fé, 02/1927 (J. Hubrich), 2 ♂, MACN; Alta Gracia, Córdoba, 01/1925 (C. Bruch), avec *Eciton dulcius jujuyensis* For., 1 ♂, ZFMK. Lm = 3,8 (3,4—4,1) mm; lm = 3,2 (2,8—3,9) mm (N = 12).

Colonides quadriglumis (Reichensperger, 1923)

C. quadriglumis: Mazur 1984: 305.
Xylostega quadriglumis: Reichensperger 1924: 120; Helava et al. 1985: 203.

Lectotype (présente désignation): une ♀ étiquetée: "Rio Negro Paraná coll. Reichensperger" (ét. imp.) / "E. quadriglume" (ét. man.) / "Colonides quadriglumis Reichensp." (ét. man.). L = 4 mm; l = 3,5 mm. ZFMK. Paralectotypes (présente désignation): un ♂ étiqueté: "Xylostega quadriglumis Reichensp." (ét. man. à cadre noir) / "Rio Negro Paraná" (man. à cadre noir) / "E. quadriglume" (man. à cadre noir) / "Paratyp." (ét. rouge man.). ZFMK; une ♀ étiquetée: "Rio Negro Paraná coll. Reichensperger" (ét. imp.) / "Paratypus" (ét. verte man.) / "Xylostega quadriglumis Reichensp." (ét. avec liséré rouge man.). L = 4,1 mm; l = 3,7 mm. MACN; un ♂ étiqueté: "Xylostega quadriglumis Reichensp." (ét. man.) / "Eciton (imp.) quadriglume Paraná" (man.) / "A. Reichensperger (imp.) Paratype (man.)" / "Syntypus" (ét. rouge imp.). L = 3,9 mm; l = 3,8 mm. DEIC. L'existence de ce dernier exemplaire a été signalée par Gaedike (1984: 461) et les données relatives à son sexe, son étiquetage et ses dimensions nous ont été très aimablement communiquées par le Dr. M. Zerche et le Pr. H. J. Müller.

Diverses caractéristiques éloignent cette espèce de *C. collegii* et l'apparentent à *C. hubrichi:* stries élytrales non raccourcies, stries prosternales rapprochées, méso-métasternum et 1er sternite abdominal à striation longitudinale dense et en réseau, rebord préapical du propygidium nettement ondulé, carènes latérales du pygidium prolongées basalement. Par contre, *C. quadriglumis* est dépourvu de strie mésosternale supplémentaire et ses côtes élytrales sont toutes également élevées.

La fourmi-hôte, *Eciton quadriglume* (Haliday), semble pouvoir être rencontrée dans tout le bassin amazonien et dans le sud-est du Brésil (Watkins II 1976).

Quelques notes sur le comportement de cette espèce dans les fourmilières et les colonnes de son hôte (et d'*E. burchelli!*) ont été publiées par Reichensperger (1926: 197).

Matériel: Brésil: Rio Negro, Paraná (J. F. Zikan), 2 ♀, FIOC; idem, (P. M. Witte), 2 ♀, ZFMK; idem, 1 ♂, 1 ♀, FMNH; Blumenau, avec *Eciton quadriglume*, 1 ♀, ZFMK. Lm = 4,1 (3,9—4,1) mm; lm = 3,7 (3,5—3,8) mm (N = 7).

Clé de détermination des espèces et sous-espèce de *Colonides*

Caractères du genre en partie selon Helava et al. (1985: 133—135): scape antennaire dilaté; proépisternum sans fossette ni aire sétigère; lobe prosternal non triparti; mandibules sans fovea ni incision basale; élytres et pronotum avec des côtes longitudinales (5 sur le pronotum); marges latérales non incisées en arrière des angles antérieurs; forme du corps ovale et peu convexe, les rebords plus ou moins relevés; suture méso-métasternale sans foveae; seules la côte pronotale médiane et les deux externes entières, les autres raccourcies; 8e sternites du mâle avec des "disques" apicaux et 10e tergite bien sclérifié .... *Colonides* (= *Xylostega*)

1 Couleur brune ou marron; ponctuation méso-métasternale forte et confluente mais non longitudinalement strigueuse; rebord préapical du propygidium non nettement ondulé; côtes élytrales dorsales jamais entières 2
1' Couleur sombre, presque noire; méso-métasternum et 1er sternite abdominal longitudinalement strigueux; rebord préapical du propygidium nettement ondulé 3

2 Une seule côte élytrale entière; ponctuation du pygidium de la femelle (mâle inconnu) confluente, rendant les carènes longitudinales indistinctes ... *Colonides collegii guyanensis*
2' Au moins deux côtes élytrales entières; carènes pygidiales longitudinales bien visibles dans la ponctuation forte mais peu confluente .... *Colonides c. collegii*

3 Côte élytrale dorsale médiane beaucoup plus élevée que les autres; une strie mésosternale supplémentaire en avant de la suture méso-métasternale .... *Colonides hubrichi*
3' Toutes les côtes élytrales faiblement mais également élevées; pas de strie mésosternale supplémentaire en avant de la suture méso-métasternale ....
.... *Colonides quadriglumis* (? = *Colonides drakei*)

Cossyphodister Reichensperger, 1936

Cossyphodister: Mazur 1984: 315; Helava et al. 1985: 185.

Cossyphodister schwarzmaieri Reichensperger, 1936

C. schwarzmaieri: Mazur 1984: 315; Helava et al. 1985: 186.

Lectotype (présente désignation): une ♀ étiquetée: "Cossyphodister schwarzmaieri Reichensp." (ét. man. à cadre noir) / "Type! Reichensperger (imp.) ♀ (man.)" (ét. rouge) / "n. g. Sta. Cruz., Goyaz 19.5.35. P. Schwarzm" (man. à cadre noir). ZFMK.

La récolte de deux exemplaires en région amazonienne étend sensiblement l'aire de répartition de cette espèce.

Matériel: Brésil: Campinas, Goias, avec *Syntermes*, 24/03/1938 (Borgmeier) 1 ex., FIOC; Tucurui, Para, piège d'interception, 1 ex. CHND; Caiçarinha, Mirador, Maranhão, 21—29/05/1993, piège d'interception, 1 ex. CHND.

Ecclisister Reichensperger, 1935

Ecclisister: Mazur 1984: 304; Helava et al. 1985: 322.

Ecclisister bickhardti (Reichensperger, 1923)

E. bickhardti: Mazur 1984: 304; Helava et al. 1985: 324.

Lectotype (présente désignation): un ex. étiqueté: "Cyclechinus bickhardti n. sp. Reichensp." (man. à cadre noir) / "Eciton burchelli" (man. à cadre noir) / "St. Catarina Blumenau" (imp.) / "Coll. Reichensperger" (imp. à cadre noir) / "TYPUS" (ét. rouge imp.) / "Ecclisister Bickhardti Reichensp." (man.). ZFMK. Paralectotypes (présentes désignations): un ex. étiqueté: "Cyclechinus bickhardti n. sp. Reichensp." (man. à cadre noir)/ "Eciton burchelli" (man. à cadre noir) / "St. Catarina Blumenau" (imp.) / "Coll. Reichensperger" (imp. à cadre noir) / "Cotype" (ét. rouge imp.) / "Ecclisister Bickhardti Reichensp." (man.). ZFMK; un ex. étiqueté: "Cyclechinus bickhardti n. sp. Reichensp." (man. à cadre noir) / "Eciton burchelli" (man. à cadre noir) / "St. Catarina Blumenau" (imp.) / "Coll. Reichensperger" (imp. à cadre noir) / "Cotype" (ét. rouge imp.) / "Ecclisister Bickhardti Reichensp." (man.). ZFMK.

Matériel: Brésil: Utinga (IPEAN), Belém, Para, 18/08/1984, dans nid d'*Eciton* dans tronc creux au sol, 1 ex.; Altamira-Maraba Km 18, Para, 14/04/1986, dans bivouac d'*Eciton burchelli*, 1 ex., CHND. Guiana: Kartabo, 15/04/1919, avec *Eciton hamatum*, 1ex. CHYG.

Euxenister Reichensperger, 1923a

Euxenister: Mazur 1984: 321; Helava et al. 1985: 203.

Euxenister caroli Reichensperger, 1923a

E. caroli: Mazur 1984: 321; Helava et al. 1985: 205.

Lectotype (présente désignation): un ex. étiqueté: "Euxenister n. caroli n. Reichensperger" (man. à cadre noir) / "Eciton burchelli" (man. à cadre noir) / "St. Catarina Blumenau" (imp.) / "Coll. Reichensperger" (imp.) / "TYPUS I." (ét. rouge imp. et man.). ZFMK. Paralectotype (présente désignation): un ex. étiqueté: "Euxenister caroli n. Reichensp." (man. à cadre noir) / "Eciton burchelli" (man. à cadre noir) / "St. Catarina Blumenau" (imp.) / "Reichensperger" (imp.) / "Cotype" (ét. rouge imp.). ZFMK.

Matériel: Guyane française: Saül, 3/08/1978, dans colonne migratrice d'*Eciton burchelli* (dét. W. L. Overal), 2 ♀, 1 ♂, CHND.

Hemicolonides Reichensperger, 1939

Hemicolonides: Mazur 1984: 305.
Oudaimosister sensu Helava in Helava et al. 1985: 261; figs 187—190.
Oudaimosister Helava, in Helava et al. 1985 = *Mesynodites* Reichardt, 1924, nouvelle synonymie.

L'illustration et la description fournies pour définir le genre *Oudaimosister* Helava s'appliquent à peu de détails près à l'holotype d'*Hemicolonides plaumanni* (fig. 64). Par contre, la description originale de *Mesynodites verruculosus* Reichensperger, espèce-type de *Oudaimosister*, est en contradiction avec la diagnose de ce dernier genre en ce qui concerne les caractères suivants: ponctuation sétigère, pronotum régulièrement convexe à partir des côtés, stries subhumérales des élytres non carènées, pygidia simples, lisses, à ponctuation peu dense, strie mésosternale antérieure indistincte, ponctuation sternale très espacée, effacée par places, pas de suture visible entre le méso- et le métasternum, pas de stries postcoxales sur le 1er sternite abdominal, etc. En conséquence, nous considérons le genre *Oudaimosister* synonyme du genre *Mesynodites* Reichardt.

Hemicolonides plaumanni Reichensperger, 1939

H. plaumanni: Mazur 1984: 305.

Holotype (par monotypie): un ex. étiqueté: "F. Plaumann Nova Teutonia Brasilien" (ét. imp.) / "Eciton praedator (imp.) 12.II.37 (man.)" / "Hemicolonides Plaumanni Reichensp." (ét. man.) / "Geno- (man.) TYPUS (imp.)" (ét. rouge). L = 1,6 mm; l = 1,4 mm. ZFMK.

L'aspect de cette espèce en vue dorsale est montré sur la fig. 64. Elle se distingue de l'espèce suivante par sa forme moins allongée (rapport L/l = 1,14 contre L/l = 1,30 pour *H. parvulus*), par l'absence de strie transversale antérieure sur le pronotum et par la présence de 8 côtes dorsales (au lieu de 6) sur chaque élytre.

Hemicolonides parvulus (Lewis, 1891), nouvelle combinaison

Colonides parvulus Lewis 1891: 404; Mazur 1984: 305; Helava et al. 1985: 200.

Lectotype (présente désignation): un ♂ étiqueté: "Mexico A. G." (ét. man.) / "Colonides parvulus Lewis Type." (ét. man.) / "Type" (ét. ronde à bordure rouge) / "Georges Lewis Coll. B. M. 1926—369" (ét. imp.) / "SYNTYPE" (ét. ronde à bordure bleue) / "Hemicolonides parvulus (Lewis) n. comb. lectotype N. DEGALLIER" (ét.man.). L = 1,4 mm; l = 1,0 mm. BMNH.

L'étude des types d'*Hemicolonides plaumanni* Reichensperger et de *Colonides parvulus* Lewis nous a convaincu de l'appartenance de ces deux espèces au même genre, par ailleurs très distinct du genre *Colonides* sensu Schmidt. En outre, le spécimen ayant servi de base à la description de *Oudaimosister verruculosus* sensu Helava est extrêmement ressemblant sinon identique (nous ne l'avons pas eu en notre possession) au lectotype d'*Hemicolonides parvulus* (Lewis). Cependant, chez ce dernier, les 8e sternites (figs. 68—69) ne sont pas "séparés" mais soudés en une plaque impaire portant de chaque côté des "soies apicales", les 9e tergites (figs. 70—71) sont munis d'apodèmes ventraux et les "guides internes" de l'édéage, assez globuleux, ne sont pas transversaux mais parallèles à l'axe longitudinal.

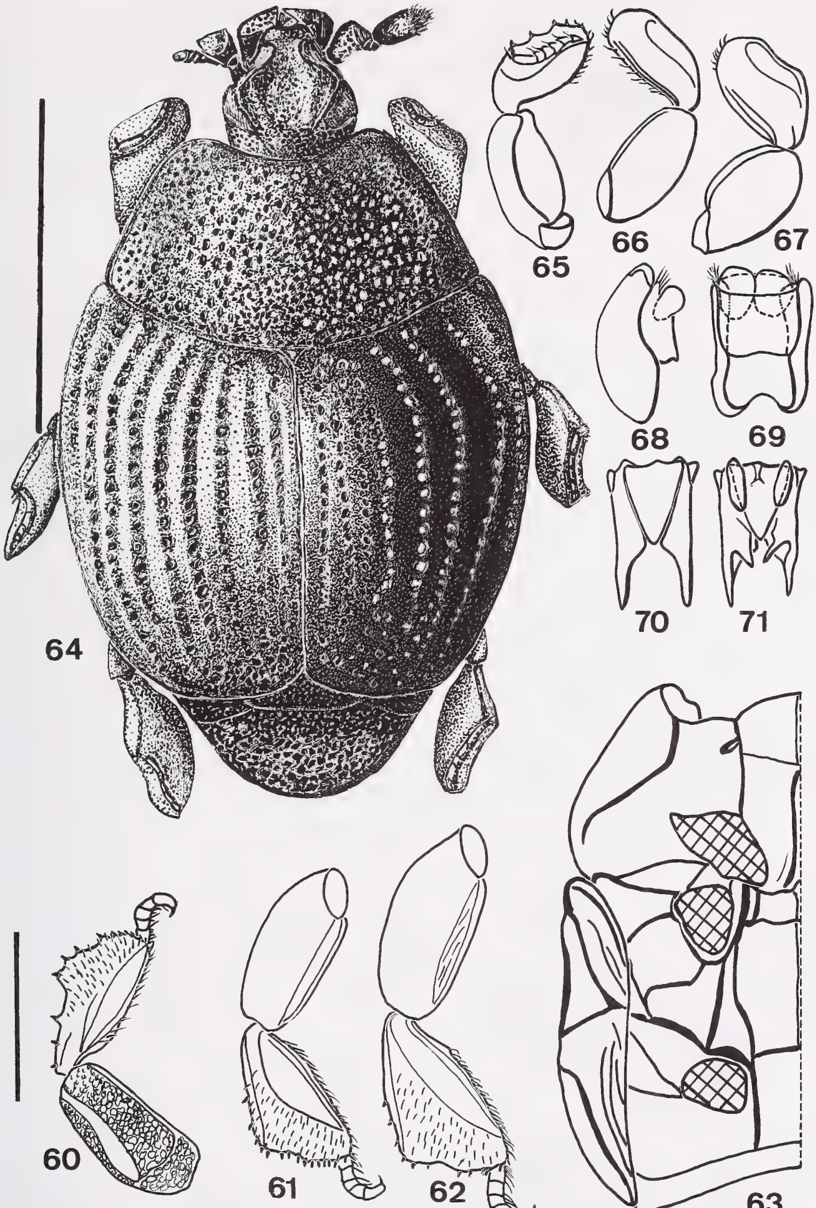
Nous compléterons les données relatives à ce taxon par les figs 65 à 67.

Matériel: Brésil: route Altamira-Maraba, km 18 (52°O3'W—3°09'S), Pará, 3—21/04/1986 piège d'interception, 1 ♂. L = 1,4 mm; l = 1,0 mm. CHND.

Hetaeriarchus Reichensperger, 1936a, nomen nudum

Hetaeriarchus Reichensperger, 1936a: 190; Borgmeier, 1948: 377.

La description de ce genre, très succincte (". . . sie gibt ganz den gewöhnlichen Histeridentyp wieder, besitzt aber die verwachsene Fühlerkeule und die Fühlergruben der Hetaeriomorphinen."), a été appliquée à un (ou plusieurs ?) Histéride(s) récolté(s) par ". . . Herrn Plaumann in Südkrasilien (sic.!) bei *Eciton praedator* . . .". L'auteur n'a malheureusement pas désigné d'espèce-type, rendant ce nom indisponible (Code, 1985: Art. 13(b)).



Figs 60—71; figs 60—63: *Neocolonides howdeni* n. gen. n. sp. — 60, patte antérieure an vue ventrale, 61, patte médiane en vue ventrale, 62, patte postérieure en vue ventrale, 63, sterna et pleures, vue latéro-ventrale droite; fig. 64: *Hemicolonides plaumanni*, habitus en vue dorsale; figs. 65—71: *Hemicolonides parvulus* — 65, patte antérieure en vue dorsale, 66, patte médiane en vue ventrale, 67, patte postérieure en vue ventrale, 68, tergite et sternite 8 du mâle vus de profil gauche, 69, idem en vue ventrale, 70, tergite et sternite 9 du mâle en vue dorsale, 71, idem en vue ventrale. Echelles 1 mm: en bas pour les figs. 60—63; en haut pour les autres figs.

Une recherche effectuée dans l'ensemble de la collection Reichensperger ne nous a pas permis de trouver d'exemplaire correspondant à cette publication. Par contre, dans le fichier bibliographique manuscrit de A. Reichensperger, mis à notre disposition par le Dr. H. Roer (ZFMK, Bonn), nous avons pu lire la mention: "Hetaeriarchus nom. nud. = Phelister sculpturatus u. praedatoris.", taxon publié comme espèce en 1939.

Latronister Reichensperger, 1932

Latronister: Mazur 1984: 320; Helava et al. 1985: 298.

Latronister breyeri (Bruch, 1931), nouvelle combinaison

Euxenister breyeri: Mazur 1984: 321; Helava et al. 1985: 205.

Holotype (par monotypie): une ♀ étiquetée: "Euxenister Breyeri Bruch (man.) C. BRUCH DETERM. (imp.)" / "con Ectatomma quadridens F. Sm." (man.) / "Typus" (rouge man.) / "1031." (man.) / "REP. ARGENTINA PATQUIA" (imp.). MACN.

Les figs. 72 à 74 montrent quelques particularités de cette espèce. D'après les descriptions (l'holotype de l'espèce-type du genre, *L. rugosus* Reichensperger n'a pu être retrouvé) et le seul exemplaire femelle étudié, cette espèce ne peut être maintenue dans le genre *Euxenister.* Du matériel complémentaire permettra, par l'étude des genitalia mâles, de confirmer ou d'infirmer sa réunion au genre *Latronister.*

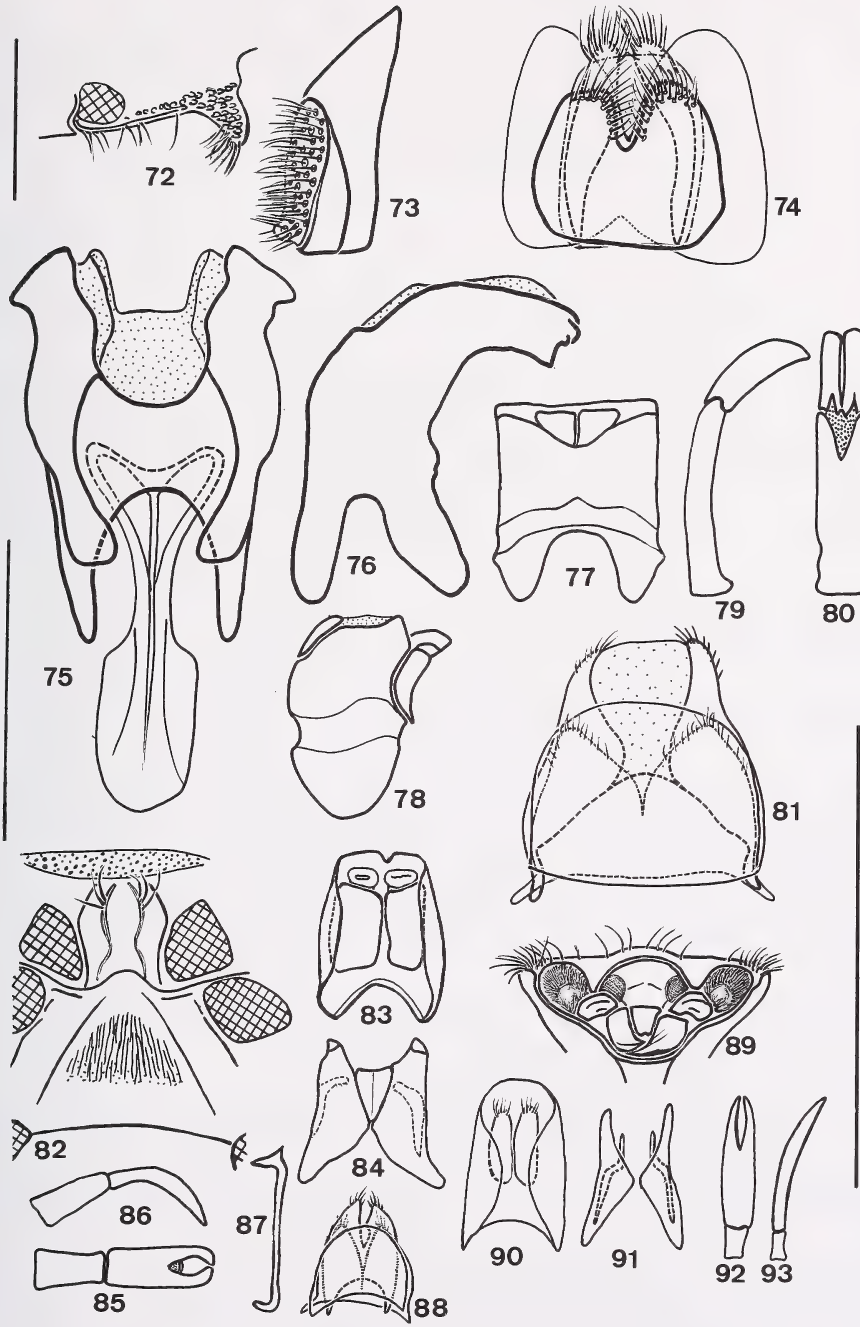
Neocolonides, nouveau genre

Espèce-type: *N. howdeni*, nouvelle espèce

Comme nous l'avons déjà noté (Dégallier 1987: 220), les descriptions et illustrations fournies par Helava et al. (1985: 195—197) pour caractériser le genre *Hemicolonides* Reichensperger ne correspondent aucunement à celles publiées par l'auteur de ce genre. De plus, un exemplaire probablement conspécifique de Hemicolonides n. sp. 1 sensu Helava et al. (1985) s'est révélé être extrêmement différent de l'holotype de l'espèce-type *H. plaumanni* Reichensperger.

Le genre *Neocolonides* est donc caractérisé par la description ("Diagnosis") et les figs. 82 à 85 données par Helava et al. (1985: 195—197) ainsi que nos figs. 58 à 63. Nous compléterons cette diagnose par les notes suivantes: ponctuation des téguments forte et confluente, formant une réticulation; labre non sétigère; pygidium avec, en plus de la carène médiane, une carène longeant les côtés et l'apex (fig. 58); carènes prosternales divergeant en arrière et convergeant sans se réunir en avant; stries prosternales latérales externes ("lateral marginal striae" de Helava et al. 1985) se terminant dans une fossette de chaque côté à la base du lobe pronotal (fig. 63); genitalia femelles comme dans le genre *Colonides* mais avec les sclérites ventraux (st. 8) dépourvus de soies, moins allongés et les coxites (st. 9) à extrémité triangulaire (arrondie chez *Colonides*) (fig. 59).

Figs 72—93; figs 72—74: *Latronister breyeri* — 72, prosternum vue du profil droit, 72, pygidia, vus du profil droit, 74, genitalia femelles en vue ventrale; figs. 75—81: *Panoplitellus comes* — 75, tergite et sternite 9 du mâle en vue dorsale, 76, tergite 9 vu du profil gauche, 77, tergite et sternite 8 du mâle en vue dorsale, 78, idem, profil gauche, 79, édéage, profil gauche, 80, idem en vue dorsale, 81, genitalia femelles en vue dorsale; figs. 82—88: *Parasynodites suturacava* — 82, sterna, 83, tergite et sternite 8 du mâle en vue ventrale, 84, tergite 9 du mâle en vue dorsale, 85, édéage en vue dorsale, 86, idem, profil gauche, 87, sternite 9 du mâle, profil gauche, 88, genitalia femelles en vue dorsale; figs. 89—93: *Pelatetister pretiosus* — 89, pronotum et tête en vue antérieure, 90, tergite et sternite 8 du mâle en vue ventrale, 91, tergite 9 du mâle en vue dorsale, 92, édéage en vue ventrale, 93, idem, profil gauche. Echelles 1 mm: à gauche en haut pour les figs. 72—73, 77—80; à gauche au milieu pour les figs. 74—76, 81; à droite pour les autres figs.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Neocolonides howdeni, nouvelle espèce

Holotype: 1 ♀ étiquetée: "PANAMA-Canal Zone Barro Colorado Island VI-4: 63" (imp.) / "Host: Eciton hamatum Colony E-340" (imp.) / "R. D. Akre #100 preserved VI-4-63" (man.) / "Xylostega n. sp. #1" (man.). L = 2,6 mm; l = 2,3 mm. FMNH. Paratype: 1 ♂, illustré par la fig. 82 (et peut-être les figs. 83 à 85: voir ci-dessous) du travail de Helava et al. (1985: 196) et cité de "PANAMA. Canal Zone: Barro Colorado Island. HOST: Neivamyrmex pilosus."

Remarque sur le choix de l'holotype: Nous n'avons malheureusement pas pu examiner l'exemplaire mâle figuré par Helava et al. (1985) car sa localisation nous est restée inconnue, ceci malgré les interventions bienveillantes du Pr. H. F. Howden auprès de J. V. T. Helava. Vus, d'une part, l'incertitude qui subsiste dans l'association entre le mâle et la femelle de cette espèce et d'autre part, le fait que les fourmis hôtes de ces deux exemplaires appartenaient à des genres différents, il nous a semblé plus "prudent" de désigner comme holotype la femelle (voir à ce propos la Recommandation 73B du Code International de Nomenclature Zoologique).

Description: Tous les caractères, exceptés ceux concernant les genitalia mâles, énumérés par Helava et al. (1985) dans la diagnose du genre *Hemicolonides* sensu Helava, s'appliquent à l'holotype désigné. Nous les compléterons par les suivants: corps entièrement brun-rouge avec des zones ou tâches noires irrégulières; élytres avec quatre côtes entières, les deux premières (externes) faiblement marquées, les deux suivantes plus relevées, une côte suturale de hauteur intermédiaire; pattes comme sur les figs. 60 à 62; longueurs des pro-, méso-, métasternum et 1er sternite abd. respectivement égales à 0,5 mm, 0,1 mm, 0,3 mm et 0,2 mm.

Nomadister Borgmeier, 1948

Nomadister: Mazur 1984: 317; Helava et al. 1985: 355.

Nomadister papillatus Borgmeier, 1948

N. papillatus: Mazur 1984: 317; Helava et al. 1985: 356.

Holotype (par désignation originale): une ♀ étiquetée: "Nomadister papillatus Borg. Holotypus det. Borgmeier" (man. avec bordure noire) / "typus" (rouge imp.) / "Goiás, Trindade Schwarzmaier 21. 9. 36 pseudops" (imp. et man.) / "N. pseudops" (man.) / "Nomadister papillatus Borgm." (man. à bordure noire) / "Neivam. pseudops" (man. à bordure noire) / "MUSEUM KOENIG BONN" (jaune imp.). L = 1,5 mm; l = 1,3 mm. ZFMK.

La structure des genitalia femelles (fig. 114) confirme l'appartenance de ce genre à la sous-famille des Hetaeriinae.

Panoplitellus Hedicke, 1923

Panhoplites: Reichensperger 1924: 129 et suiv.
Panoplitellus: Mazur 1984: 299; Helava et al. 1985: 287.

Description des genitalia: ♂: tergite 8 (figs. 77—78) avec une strie transverse antérieure, sans expansions ventrales sur le bord postérieur; sternites 8 séparés, avec des disques, sans soies à l'apex; tergite 9 (figs. 75—76) avec des apodèmes ventraux et des guides internes pour l'édéage, sans prolongements apicaux en crochet; sternite 9 épaissi dans sa moitié basale; tergite 10 présent, membraneux; édéage (figs. 79—80) à pièce basale longue et paramères courts.

♀ (fig. 81): sternite 8 à apodèmes très courts, avec des lobes sétigères larges à la base et pointus à l'apex; tergite 9 sans prolongement médian proximal; sternite 9 avec des coxites sétigères, sans style et soudés à leurs apodèmes qui sont très courts.

Les caractères ci-dessus permettent de confirmer le placement de ce genre dans le groupe E, sous-groupe E3 de Helava et al. (1985).

Panoplitellus comes (Reichensperger, 1923a)

P. comes: Mazur 1984: 299; Helava et al. 1985: 289.

Deux exemplaires récoltés en Amazonie correspondent parfaitement aux descriptions et illustrations publiées pour ce taxon.

Matériel: Brésil: Altamira-Maraba km 18 (52°O3'W—3°09'S), Pará, 14/04/1986, dans bivouac de *Eciton burchelli*, 1 ♂, 1 ♀, CHND; P. N. Itatiaia 800 m, Rio de Janeiro, 02/1957 (Vulcano & Martinez), avec *Eciton quadriglume* (Dégallier dét.), 1 ex., AMIC. Lm = 4,1 (3,9—4,4) mm; lm = 3,3 (3,2—3,4) mm (N = 3).

Parasynodites Bruch, 1930

Parasynodites: Mazur 1984: 311; Helava et al. 1985: 357.

Description complémentaire: Corps 1,2 fois aussi long que large, garni de longues soies éparses, plus denses le long des côtés du pronotum.

Tête aussi large que longue, faiblement carènée sur les marges allant du vertex au clypeus; vertex et front élargis, le premier sans stries divergentes; scape antennaire anguleusement dilaté; massue presque entièrement sclérotisée; labre à apex coupé droit, deux fois aussi large que long, soudé au clypeus mais avec une suture visible les séparant; mandibules avec une fossette près de la base sur leur surface externe.

Pronotum deux fois aussi large que long, dépourvu de striation en réseau ou de fossettes.

Elytres sans 4eme strie dorsale et sans côtes.

Pro-, méso-, métasternum et 1er sternite abdominal (fig. 82) de longueurs respectivement égales à 0,3; 0,1; 0,3 et 0,3 fois la longueur totale des sterna (0,8 mm); lobe prosternal non divisé, incliné presque à angle droit par rapport au prosternum; carène avec quelques soies alignées entre les stries carènales et les stries latérales; carène sans processus antérieur; base prosternale largement incisée; proépisternum et proépimère sans touffes de soies; une fossette ronde creuse les angles postérieurs de chaque côté. Mésosternum sans fossettes profondes mais creusé d'une large excavation qui se continue sur le métasternum. Hanches médianes et postérieures très éloignées, la distance entre les premières égale à 1,3 fois la longueur du méso-métasternum. Métasternum avec une seule strie latérale.

Tibias sans éperons.

Genitalia mâles (figs. 83—87): tergite 8 avec une bande transversale apicale translucide sinon une strie apicale, sans expansion ventro-postérieure; sternites 8 presque fusionnés, avec des disques, sans soies apicales; tergites 9 sans apodèmes ventraux, avec des guides internes de l'édéage, la marge apicale sans prolongement en crochet mais portant une lamelle dorsale triangulaire et translucide; tergite 10 présent; édéage à pièce basale longue et paramères longs, recourbés presque à angle droit, très largement et profondément fendus (sur 1/3 de leur longueur) apicalement.

Genitalia femelles (fig. 88): sternite 8 à apodèmes proximaux très courts, des lobes sétigères apicaux; tergite 9 sans prolongement médian proximal; sternite 9 à coxites à apex sétigère, sans style, soudés à leur apodèmes et médialement.

Remarque: Par l'aspect de ses téguments, la conformation des sterna et la morphologie des genitalia mâles, ce genre rappelle le genre *Lissosternus* Lewis. Il s'en distingue cependant par l'aspect des mandibules, des bords latéraux du pronotum et la forme des pattes.

Parasynodites suturacava Bruch, 1930

P. suturacava: Mazur 1984: 312; Helava et al. 1985: 357.

Lectotype (présente désignation): un ♂ étiqueté: "Parasynodites suturacava Bruch (man.) C. BRUCH DETERM. (imp.)" (ét. blanche à cadre noir) / "Typus" (ét. verte man.) / "700." (man.) / "ROSAS-F. C. Sud Provincia de Buenos Aires JUAN B. DAGUERRE" (ét. blanche imp.). L = 1,0 mm; l = 0,9 mm. MACN. Paralectotypes (présente désignation): une ♀ étiquetée: "Parasynodites suturacava Bruch (man.) C. BRUCH DETERM. (imp.)" (ét.

blanche à cadre noir) / "Typus" (ét. verte man.) / "700." (man.) / "ROSAS-F. C. Sud Provincia de Buenos Aires JUAN B. DAGUERRE" (ét. blanche imp.). L = 1,0 mm; l = 0,9 mm. MACN. Un ♂ étiqueté: "ROSAS-F. C. Sud Provincia de Buenos Aires JUAN B. DAGUERRE" (ét. blanche imp.) / "Typus" (ét. verte man.). L = 1,0 mm; l = 0,9 mm. MACN. Un ♂ étiqueté: "700." (man.) / "ROSAS-F. C. Sud Provincia de Buenos Aires JUAN B. DAGUERRE" (ét. blanche imp.). L = 1,0 mm; l = 0,9 mm. MACN. Un ex. étiqueté: "Parasynodites suturacava Bruch (ét. man.)" / "cotypus" (man.) / "cotypus" (ét. rouge imp.) / "ROSAS-F.C. Sud Provincia de Buenos Aires JUAN B. DAGUERRE" (ét. blanche imp.). ZFMK. Un ex. étiqueté: "Parasynodites suturacava Bruch (ét. man. à cadre noir)" / "Paratypus (imp.) Co (man. par dessus)" (ét. rouge)/ "Cotypus" (ét. verte man.) / "ROSAS-F. C. Sud Provincia de Buenos Aires JUAN B. DAGUERRE" (imp.). ZFMK.

Pelatetister Reichensperger, 1939

Pelatetister: Mazur 1984: 112; Helava et al. 1985: 357.

Pelatetister pretiosus Reichensperger, 1939

P. pretiosus: Mazur 1984: 112; Helava et al. 1985: 359.

Lectotype (présente désignation): un ♂ étiqueté: "Pelatetister pretiosus Reichensp." (ét. man. à liséré noir) / "Hamburg-Farm Costa Rica Nevermann" (imp.) / "E. (Acamatus) pilosum. c. Reichensperger" (imp.) / "Type! Reichensperger" (ét. rouge). L = 1,0 mm; l = 0,9 mm. ZFMK. Paralectotype (présente désignation): un ♂ étiqueté: "Pelatetister pretiosus Reichensp." (ét. man. à liséré noir) / "Hamburg-Farm Costa Rica Nevermann (imp.) 8 35 XI (man.)" (ét. à cadre noir) / "E. (Acamatus) pilosum. c. Reichensperger" (imp.) / "Paratype! Reichensperger" (ét. rouge). L = 1,0 mm; l = 0,9 mm. ZFMK.

Dans le travail de Mazur (1984), ce taxon est classé dans la sous-famille des Chlamydopsinae, endémique de la région indo-australienne. Mise à part une ressemblance superficielle avec les représentants de ce groupe (Reichensperger 1939), cette interprétation ne peut être maintenue car *Pelatetister* est bien un Hetaeriinae. Il ne possède aucune des synapomorphies mises en évidence chez les Chlamydopsinae: pincements ou fentes ("épaulettes") au niveau des épaules élytrales, massues antennaires au moins trois fois plus longues que larges et non sclérifiées sur une partie de leur surface, scape antennaire recouvrant la massue au repos etc. *Pelatetister* possède au contraire au moins deux des synapomorphies présentes chez les Hetaeriinae, qui sont la massue antennaire ovale et en partie sclérifiée, fermant les cavités antennaires au repos (fig. 89) et les genitalia mâles "raccourcis" (figs. 90—93), assez semblables à ceux figurés par Helava et al. (1985) pour le genre *Pterotister*. Les genitalia femelles sont malheureusement inconnus. Le caractère "saprinomorphe" (Wenzel 1944) ou raccourcissement extrême du lobe prosternal, partagé avec les Chlamydopsinae, ne peut être considéré comme une synapomorphie chez ces derniers car on le rencontre aussi chez d'autres groupes d'Histeridae.

Matériel: Costa Rica: Revertazon, Hamburg-Farm (F. Nevermann), avec *Eciton* (*Acamatus*) *pilosum*, 1 ♂, ZFMK. L = 1,0 mm; l = 0,9 mm.

Procolonides Reichensperger, 1935

Procolonides: Mazur 1984: 305; Helava et al. 1985: 193.

La description et l'illustration des genitalia mâles données par Helava et al. (1985) indiquent l'absence de soies apicales et de "disques" sur le 8e sternite et l'absence de 10e tergite, alors que nous avons observé ces structures (figs. 51—52) chez tous les spécimens mâles étudiés!

Procolonides bruchi Reichensperger, 1935

P. bruchi: Mazur 1984: 305; Helava et al. 1985: 193.

Holotype (par désignation originale): non retrouvé.

La collection A. Reichensperger, à Bonn, ne contient qu'un seul exemplaire de cette espèce, accompagné d'une étiquette rouge manuscrite: "Type!" mais il ne peut s'agir que d'un topotype car la date de récolte (1951) est postérieure à celle indiquée après la diagnose originale! Ce spécimen, dont nous figurons quelques détails morphologiques jusqu'ici non décrits (fig. 56), correspond cependant exactement à la description de l'espèce. Des différences par rapport à ce topotype et à la description donnée par Helava et al. (1985) sont à mentionner pour deux spécimens, l'un cité d'Argentine par Bruch (1937: 129) et l'autre présent dans la collection T. Borgmeier (FIOC). Ces différences ont trait principalement aux caractères suivants: carène médiane du front se divisant en avant en formant un V inversé (fig. 55); fossettes pronotales non limitées par un bourrelet relevé sur leur rebord interne, un tel bourrelet n'est développé que le long de leur bord externe; stries et carènes élytrales dorsales apicalement indistinctes sur une longueur variant de $^1/_5$ à $^2/_3$ de la longueur des élytres, la strie externe étant la plus courte; propygidium à concavité dorsale régulière jusqu'au rebord apical, qui n'est pas bombé comme chez la forme typique; ponctuation pygidiale à points plus ou moins alignés dans la moitié apicale, plus forte basalement; pas d'impression basolatérale circulaire ponctuée de gros points ronds (fig. 56) (ni Reichensperger 1935, ni Helava et al. 1985 ne signalent ce caractère, net chez la forme typique); stries prosternales formant en avant un angle moins effilé que chez la forme typique (fig. 50); carène prosternale, vue de profil, sans pointe nette mais seulement un peu ondulée; stries métasternales internes obsolètes ou nulles, aucunement ramifiées ou arborescentes (fig. 50) ("baumartig" in Reichensperger 1935: 206); extrémités antérieures des stries longitudinales internes du premier sternite abdominal plus proches des coxae que du milieu de la suture métasterno-abdominale; édéage (spécimen de la FIOC) à bords parallèles (fig. 53).

Il est cependant difficile de conclure à l'existence d'un taxon distinct en l'absence de matériel complémentaire en provenance d'au moins une de ces localités.

P. bruchi semble être habituellement associé à des fourmis du genre *Solenopsis* (*S. saevissima:* Reichensperger 1935: 207; *S. s. tricuspis:* Bruch 1937: 129) mais il a aussi été récolté au Brésil en compagnie de *Eciton diversinode* (dét. T. Borgmeier, in litt., confirmée par W. L. Overal)!

Matériel: Brésil: Nova Teutonia, Sta. Catharina, 300—500 ft., 9-1951 (F. Plaumann), 1 ♂, ZFMK; idem, 15/08/1950, 1 ex.; idem, 9/09/1950, 1 ♂, BMNH; idem, 1 ♂; idem, 08/1972, 1 ♂; idem, 15/08/1950, 1 ♂, FMNH; Campinas, Goiás, 1963, 1 ♂, FIOC. Argentine: Loreto, Misiones 14/08/36 (A. Oglobin), 1 ♀, MACN. Lm = 2,5 (2,0—2,8) mm; lm = 1,6 (1,3—1,8) mm (N = 8).

Pterotister Reichensperger, 1939

Pterotister: Mazur 1984: 112; Helava et al. 1985: 214.

Pterotister schwarzmaieri Borgmeier, 1948

P. schwarzmaieri: Mazur 1984: 112; Helava et al. 1985: 216.

Matériel: Brésil: 10—27/09/1992, piège d'interception, Monte Alegre- Oriximina, Para, 1 ♂. CHND.

Ce genre, placé par Mazur (1984) dans la sous-famille des Chlamydopsinae, est bien un Hetaeriinae, pour les mêmes raisons données au sujet de *Pelatetister.*

Synoditinus Reichensperger, 1929

Synoditinus: Mazur 1984: 310; Helava et al. 1985: 360.

Synoditinus herteli Reichensperger, 1929

S. herteli: Bruch 1930: 7, figs 1—3; Mazur 1984: 310; Helava et al. 1985: 361.

Bien que la localité-type ait été citée comme "Porto Alegre Para", nous pensons qu'il s'agit

de la capitale de l'état du Rio Grande du Sud, frontalier avec l'Argentine, et non d'une localité située dans l'état du Para, situé au nord du Brésil.

L'holotype de cette espèce, l'unique de son genre (!), n'a pu être retrouvé. Cependant, l'identification faite par C. Bruch du seul spécimen que nous ayons pu avoir à notre disposition semble avoir été confirmée par Reichensperger (Bruch, 1930) et sera considérée comme fiable. La caractèristique principale de cet insecte est la forte courbure vers le dos (anatomiquement parlant) du tiers apical de sa carène prosternale (fig. 109). Le lobe prosternal est divisé en trois parties. Le tergite 8 du mâle (fig. 110) ne possède pas d'extensions ventrales mais montre une strie apicale; les sternites 8 possèdent des disques apicaux. Les tergites 9 (fig. 111) ont des expansions postéro-ventrales et des guides de l'édéage mais le tergite 10 semble absent. L'édéage (fig. 112) est formé d'une piéce basale longue et de paramères longs, divergeant à l'apex.

Matériel: Argentine: Rosas F. C. Sud Buenos Aires, (J. B. Daguerre), 1 ♂, MACN. L = 1,2 mm; l = 1,0 mm.

Teratosoma Lewis, 1885

Teratosoma: Mazur 1984: 321; Helava et al. 1985: 213.

Teratosoma longipes Lewis, 1885, sensu Helava et al. (1985)

T. longipes: Mazur 1984: 321; Helava et al. 1985: 213.

Genitalia mâles: tergite 8 avec une strie antérieure transverse, sans prolongements ventro-postérieurs; sternites 8 soudés médialement, sans soies apicales mais avec des disques sétigères (fig. 101); tergite 9 avec des apodèmes ventraux, des guides internes pour l'édéage et l'apex non prolongé en forme de crochets; sternite 9 en Y, à base non élargie (fig. 102—103); tergite 10 présent; édéage à base et paramères longs (figs. 104—105).

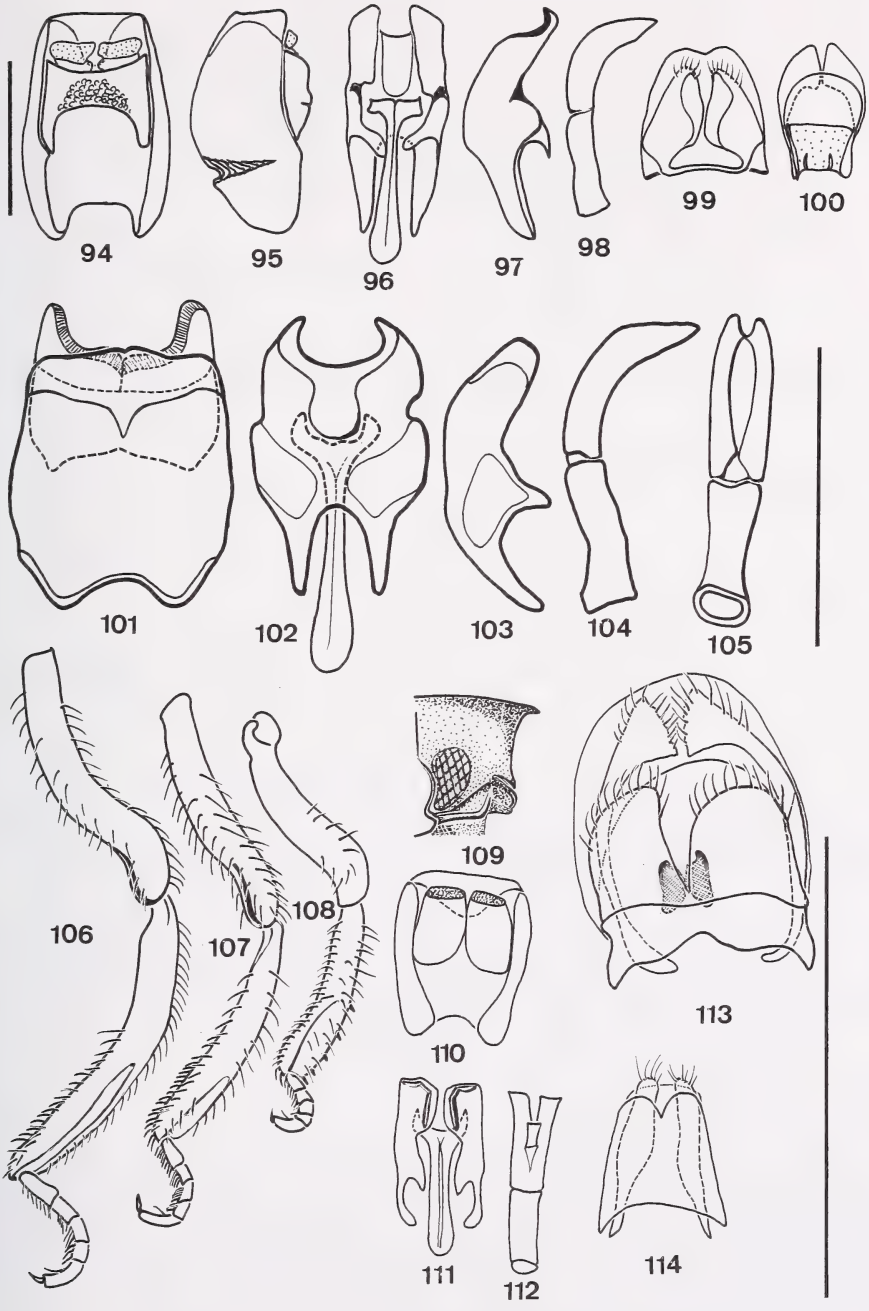
Les fémurs sont plus sinués (en forme de S) que chez l'espèce suivante (figs. 106—108).

Matériel: Brésil: Passa Quatro, avec *Eciton legionis*, 1 ♂, FMNH. Colonia Alpina Rio de Janeiro, avec *Eciton legionis*, 10/1894 (A. Göldi),1 ex., ZFMK.

Teratosoma amphiphilus (Bruch, 1926)

Neolister amphiphilus: Mazur 1984: 329.
T. amphiphilus: Helava et al. 1985: 213.

Figs 94—114; figs 94—100: *Teratosoma amphiphilus* — 94, tergite et sternite 8 du mâle en vue ventrale, 95, idem, profil gauche, 96, tergite et sternite 9 en vue ventrale, 97, *idem*, profil gauche, 98, édéage, profil gauche, 99, tergite et sternite 8 de la femelle en vue ventrale, 100, tergite et sternite 9 de la femelle en vue dorsale; figs. 101—108: *Teratosoma longipes* — 101, tergite et sternite 8 du mâle en vue dorsale, 102, tergite et sternite 9 du mâle en vue dorsale, 103, tergite 9, profil gauche, 104, édéage, profil gauche, 105, idem en vue ventrale, 106, patte postérieure, vue dorsale, 107, patte médiane en vue dorsale, 108, patte antérieure en vue dorsale; figs. 109—112: *Synoditinus herteli* — 109, prothorax en vue latéro-ventrale (coté droit), 110, tergite et sternite 8 du mâle en vue ventrale, 111, tergite et sternite 9 du mâle en vue dorsale, 112, édéage en vue ventrale; fig. 113: *Xenister schwarzmaieri*, genitalia femelles en vue ventrale; fig. 114: *Nomadister papillatus*, idem. Echelles 1 mm: à gauche pour les figs. 106—108; à droite en haut pour les figs. 94—105, 109, 113—114; à droite en bas pour les autres figs.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Lectotype (présente désignation): un exemplaire étiqueté: “Neolister amphiphilus Bruch (man. par Bruch) C. BRUCH DETERM. (imp.)” (ét. blanche) / “Typus” (ét. verte imp.) / “Foto” (ét. verte imp.) / “Alta Gracia La Granja Sierras de Córdoba C. Bruch leg.” (ét. blanche imp.). L = 1,8 mm; l = 1,2 mm. MACN. Paralectotype (présente désignation): un exemplaire étiqueté: “Typus” (ét. verte imp.) / “Alta Gracia La Granja Sierras de Córdoba. C. Bruch leg.” (ét. blanche imp.). MACN.

Genitalia mâles un peu différent de ceux de l'espèce précédente: les disques des sternites 8 sont glabres, la partie médiane de la strie apicale du tergite 8 est arrondie à l'apex (figs. 94—95), le tergite 9 est plus allongé, avec les processus antérieurs développés en forme de cuillère à concavité tournée vers le haut (figs. 96—97); tergite 10 présent (fig. 96); édéage à base et paramères longs (fig. 98).

Genitalia femelles: sternite 8 à apodèmes très réduits, les lobes distaux sétigères (fig. 99); tergite 9 sans prolongement proximal médian; sternite 9 avec les coxites soudés à leurs apodèmes, sans soies apicales et sans style (fig. 100).

Matériel: Argentine: Alta Gracia, La Granja, Sierras de Córdoba, 10/01/1927 (C. Bruch), 1 ♂; idem, 15/01/1927, 1 ♂, 1 ♀, MACN. 1 ex. (coll. Reichensperger), ZFMK. Lm = 1,9 (1,8—2,0) mm; lm = 1,3 (1,2—1,3) mm (N = 4).

Troglosternus Bickhardt, 1917

Troglosternus: Mazur 1984: 316; Helava et al. 1985: 259.

Troglosternus dasypus Bickhardt, 1917

T. dasypus: Mazur 1984: 316; Helava et al. 1985: 261.

Lectotype (présente désignation): un ♂ étiqueté: “Rio Grande do Sul” (ét. blanche imp.) / “Type” (ét. rouge imp.) / “dasypus Bickh.” (ét. man.) / “Troglosternus Bickh.” (ét. man.) / Zool. Mus. Berlin” (ét. imp. en bleu). L = 3,3 mm; l = 2,9 mm. ZMHB.

Pronotum 1,9 fois aussi large que long; striation transversale du disque pronotal atteignant à peine le milieu (fig. 115).

Pro-, méso-, métasternum et 1er sternite abdominal respectivement égaux à 0,3; 0,1; 0,3 et 0,2 fois la longueur totale des sterna (2,3 mm) (fig. 116); stries de la carène prosternale éloignées entre les hanches antérieures d'environ 0,4 fois la distance séparant la strie basale du lobe de la base du prosternum; métasternum densément strié longitudinalement.

Pattes comme sur les figs. 123 à 125.

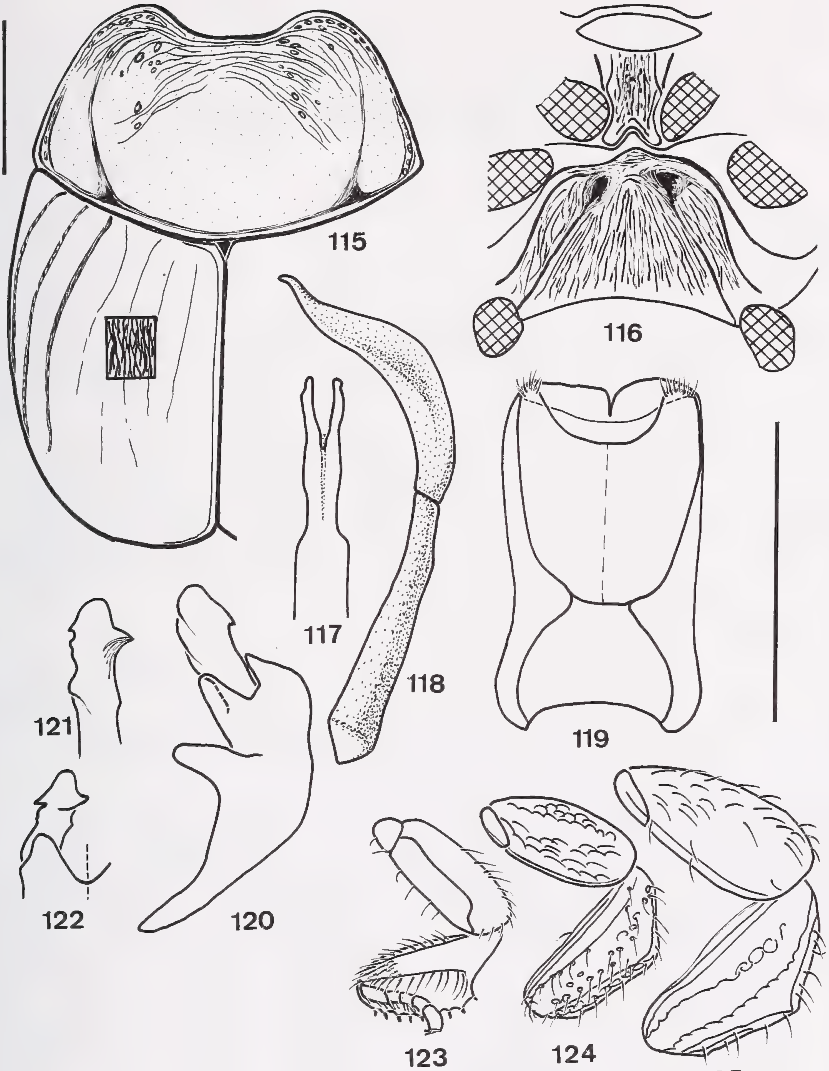
Les genitalia mâles de cette espèce diffèrent plus de ceux de *T. lisaevedouae* que de ceux de *T. ecitonis:* les sternites 8 sont soudés médialement et sont garnis d'une rangée de petites soies droites à l'apex (fig. 119); les guides internes de l'édéage (tergite 9) sont prolongés vers l'avant, armés d'un crochet sur leur face interne (figs. 120—122); les paramères (figs. 117—118) sont pointus, non aplatis en forme de spatule à l'apex.

Troglosternus ecitonis Mann, 1925

T. ecitonis: Mazur 1984: 316; Helava et al. 1985: 261.

Matériel: Panama: Canal Zone, Barro Colorado I., 25/01/59, bivouac abandonné de *Eciton burchelli*, 1 ex. comparé avec un paratype (R. L. Wenzel in litt.); idem, 3/03/1963 (R. D. Akre), avec *Eciton hamatum*, 1 ex., FMNH. Costa Rica: Punta S. Vito, Las Cruces, 1200 m, 22/02—3/03/1983 (B. Gill), 1 ♀, CHND. Lm = 2,5 (2,3—2,6) mm; lm = 2,1 (2—2,2) mm (N = 3). Brésil: Cruzeiro do Sul, Acre, Janvier-Février 1988, piège d'interception, 1 ♂, CHND. L = 2,8 mm; l = 2,4 mm.

T. ecitonis se distingue des autres espèces du genre par la ponctuation non uniforme des pygidia, caractère signalé dans la description originale mais sans doute non considéré par



Figs 115—125: *Troglosternus dasypus*, 115, pronotum et élytre gauche en vue dorsale, 116, sterna, 117, extrémité de l'édéage en vue dorsale, 118, édéage, profil droit, 119, tergite et sternite 8 du mâle en vue ventrale, 120, tergite 9 du mâle, profil droit, 121, apex du guide interne droit de l'édéage en vue ventrale, 122, apex du tergite 9 (moitié gauche) en vue dorsale, 123, patte antérieure en vue dorsale, 124, patte médiane en vue ventrale, 125, patte postérieure en vue ventrale. Echelles 1 mm: à gauche pour les figs. 115—116, 123—125; à droite pour les autres figs.

Reichensperger (cf. infra). Alors que la moitié ou les 3/4 basaux de ces structures sont densément ponctués ridés, leur partie apicale est lisse ou très éparsément ponctuée. La position de la dent du bord externe du tibia postérieur par rapport à l'apex (fig. 130) semble être un bon caractère pour séparer *T. ecitonis* d'une espèce qui a été confondue avec lui et qui est décrite ci-après. Les figs 126 et 127 montrent le dessin des stries dorsales et ventrales qui caractérisent cette espèce.

L'exemplaire récolté en Amazonie brésilienne (Etat de l'Acre) présente une striation du métasternum assez dense, comparable à celle observée chez *T. dasypus*. L'étude de matériel complémentaire reste cependant nécessaire pour classer définitivement cet insecte.

Troglosternus lisaevedouae Reichensperger, 1938

T. lisaevedouae: Mazur 1984: 316; Helava et al. 1985: 261.

Matériel: Costa Rica: San José (H. Schmidt), 2 ex., FIOC; 3 ♂ et 4 ♀, ZFMK. Lm = 2,8 (2,6—3,1) mm; lm = 2,5 (2,3—2,7) mm (N = 9).

Cette espèce est facilement reconnaissable par la pilosité très abondante et la ponctuation rugueuse et dense recouvrant presque toute la face dorsale du corps et notamment les pygidia. Par ailleurs, les metatibia sont plus étroits et parallèles que ceux des autres espèces, avec la dent externe située la plus proche de l'apex (fig. 132). Les mesures de ce caractère et de l'allongement relatif du métatibia par rapport au corps montrent néanmoins un faible recouvrement entre *T. lisaevedouae* et l'espèce décrite ci-après. Les genitalia mâles montrent plusieurs différences: expansions apicales des guides internes du tergite 9 (fig. 136) moins proéminentes que chez *T. dasypus*; paramères élargis préapicalement et aplatis en spatules à l'apex (fig. 137); genitalia femelles (fig. 139) paraissant caractéristiques du genre, le sternite 8 trilobé apicalement, les deux lobes externes sétigères; coxites (sternite 9) larges et sétigères apicalement.

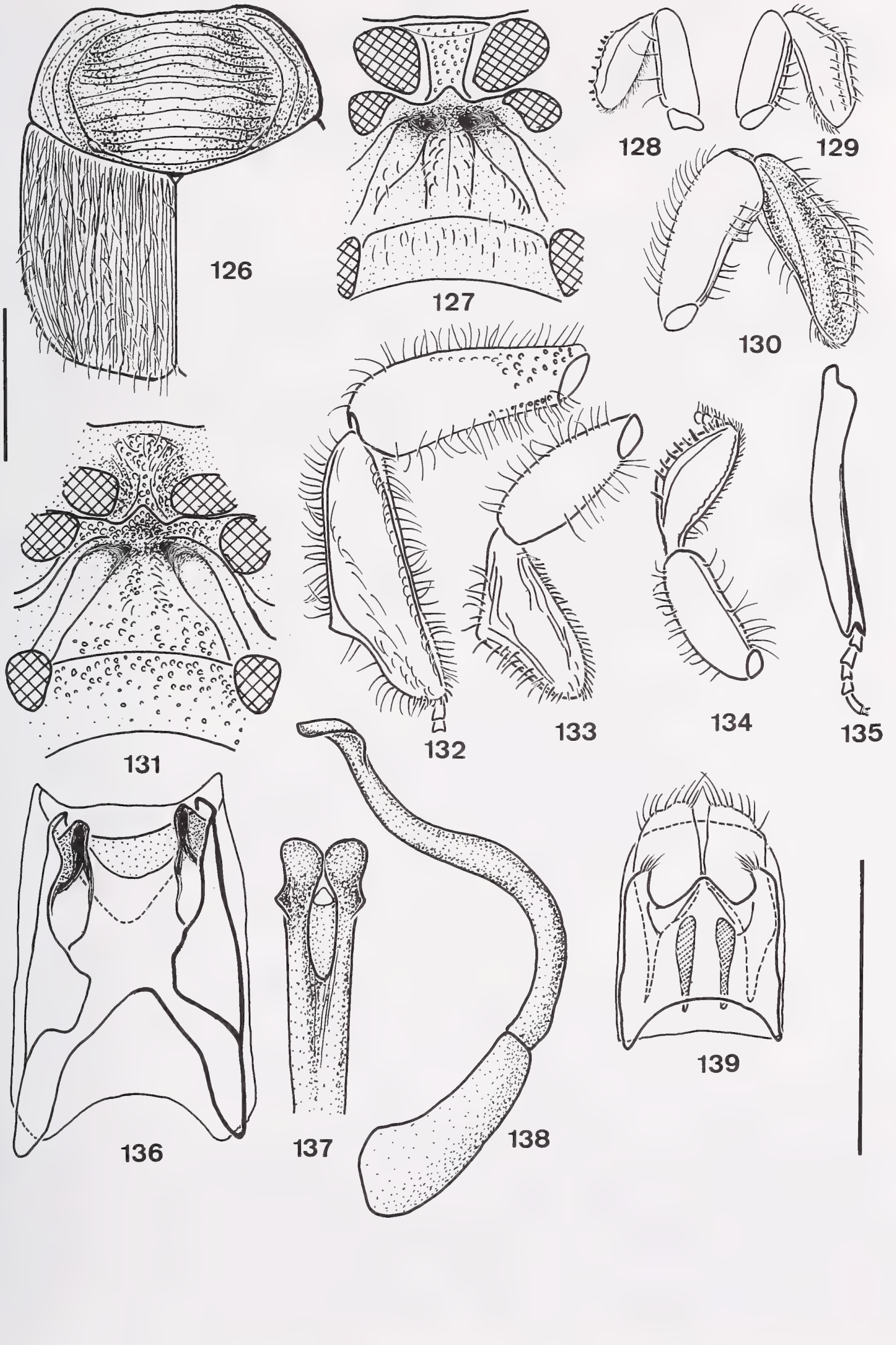
Troglosternus neoecitonis, nouvelle espèce

T. ecitonis: Reichensperger 1938: 79.

Holotype: un ♂ étiqueté: "Costa Rica San Jose H. Schmidt" (ét. imp.). L = 3,7 mm; l = 3,2 mm. ZFMK. Allotype: une ♀ étiquetée: "Costa Rica San Jose H. Schmidt" (ét. imp.). L = 3,3 mm; l = 2,9 mm. ZFMK. Paratypes: tous de la même provenance que les deux specimens précédents: un ex., FIOC; une ♀ et un ♂, ZFMK et CHND. Lm = 3,5 (3,3—3,7) mm; lm = 3,1 (2,9—3,2) mm (N = 5).

Les spécimens-types de cette nouvelle espèce ont été originellement rapportés à *T. ecitonis* par Reichensperger (1938: 79) et Borgmeier à sa suite. Ils s'en distinguent cependant par le pygidium éparsément et uniformément ponctué et la partie basale du bord externe des métatibias (avant la dent) convexe (fig. 150). La dent n'est donc pas comprise entre deux concavités comme chez les autres espèces. L'emplacement de cette dent est nettement plus proche de l'apex que chez *T. ecitonis*. *T. neoecitonis* sp. nov. ne possède pas de stries

Figs 126—139; figs 126—130: *Troglosternus ecitonis* — 126, pronotum et élytre gauche, 127, sterna, 128, patte antérieure en vue ventrale, 129, patte médiane en vue ventrale, 130, patte postérieure en vue ventrale; figs. 131—139: *Troglosternus lisaevedouae* — 131, sterna, 132, patte postérieure en vue ventrale, 133, patte médiane en vue ventrale, 134, patte antérieure en vue ventrale, 135, métatibia gauche en vue postérieure, 136, tergites 8 et 9 du mâle en vue ventrale, 137, apex de l'édéage en vue dorsale, 138, édéage, profil droit, 139, genitalia femelles en vue ventrale (tergite 9 non représenté). Echelles 1 mm: à gauche pour les figs. 126—135; à droite pour les autres figs.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supplémentaires ramifiées sur le disque du métasternum (figs. 141 vs. 127) et ses stries élytrales dorsales sont plus nettes que chez *T. ecitonis* (figs. 140 vs. 126). Comparé à *T. dasypus, T. neoecitonis* n. sp. n'a pas les pro-, méso- et métasternum striés longitudinalement (figs. 116 vs. 141) et il possède des stries transversales sur le tiers postérieur du pronotum (fig. 140). Bien qu'il soit proche de *T. lisaevedouae* par la structure des genitalia femelles (apex des lobes du sternite 8 large: fig. 142) et mâles (apex des paramères dilatés: figs. 145—146), il s'en distingue par l'aspect beaucoup moins pileux, l'absence d'un strie métasternale latérale interne (figs. 141 vs. 131) et la forme des tibias postérieurs (figs. 150 vs. 132).

La fig. 152 montre la relation entre la position relative de la dent externe des tibias postérieurs et la longueur du corps pour chacune des quatre espèces précédentes.

Xenister Borgmeier, 1929

Xenister: Mazur 1984: 311; Helava et al. 1985: 362.

Description complémentaire: Tête non ou peu carènée latéralement; vertex et front non élargis, le premier avec des stries divergentes; scape antennaire élargi; massue sclérotisée par endroits; labre triangulaire soudé au clypeus; mandibules non modifiées à la base.

Pronotum sans stries en réseau, avec des fossettes.

Elytres à 4eme strie dorsale droite, sans côtes.

Prosternum à lobe non divisé, sans processus antérieur; carène sans soies entre les stries carènales et latérales; largement incisé à la base; proépisternum et proépiméron sans touffes de soies.

Mésosternum sans fossette.

Métasternum avec une strie latérale.

Tibias sans éperons.

Genitalia femelles: sternite 8 avec les apodèmes proximaux plus courts que la partie distale, avec des lobes sétigères; tergite 9 sans prolongement proximal médian; sternites 9 avec des coxites sétigères, séparés mais soudés à leurs apodèmes, dépourvus de styles.

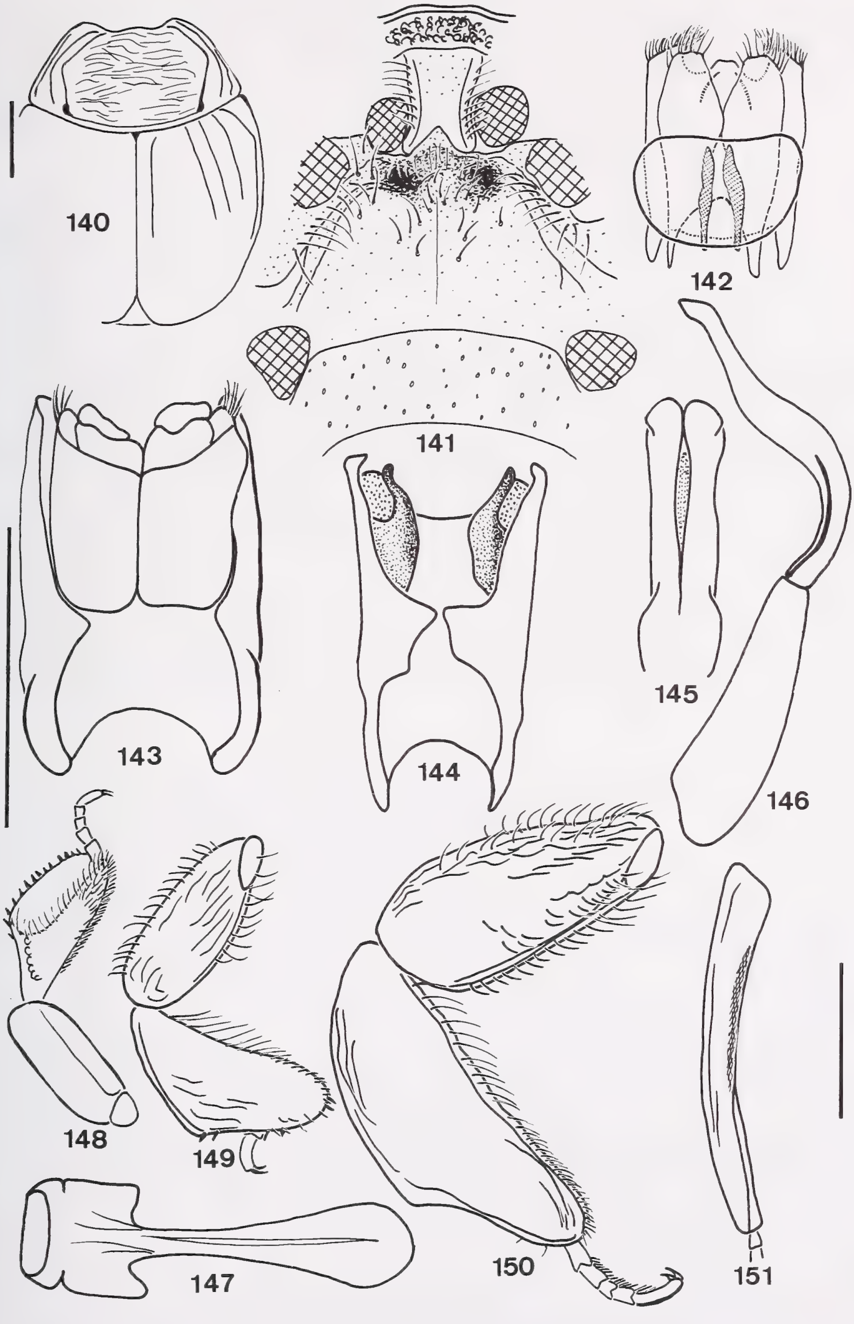
Genitalia mâles inconnus.

Xenister schwarzmaieri Borgmeier, 1929

X. schwarzmaieri: Mazur 1984: 311; Helava et al. 1985: 365.

Holotype (par désignation originale): une ♀ étiquetée: "Xenister schwarzmaieri Borg. Holotype" (ét. man. à liséré noir) / "Eciton schlechtendali" (imp. à liséré noir): "Campinas Goiaz 15. V. 29. Schwarzmaier" (imp. à liséré noir) / "TYPUS" (imp. rouge) / "MUSEUM KOENIG BONN" (ét. jaune imp.). L = 3,3 mm; l = 2,6 mm. ZFMK.

Figs 140—151: *Troglosternus neoecitonis* n. sp., 140, pronotum et élytre droit, 141, sterna, 142, genitalia femelles en vue dorsale (tergite 9 non représenté), 143, tergite et sternite 8 du mâle en vue ventrale, 144, tergite 9 du mâle en vue ventrale, 145, apex de l'édéage en vue ventrale, 146, édéage, profil droit, 147, sternite 9 du mâle en vue dorsale, 148, patte antérieure en vue dorsale, 149, patte médiane en vue ventrale, 150, patte postérieure en vue ventrale, 151, métatibia gauche en vue postérieure. Echelles 1 mm: à gauche en haut pour la fig. 140; à gauche au milieu pour les figs. 142—146; à droite pour les autres figs.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Discussion et conclusions

La présente étude n'est qu'un préalable à un travail plus ample qui abordera les problèmes posés (a) par l'identification des Hetaeriinae au niveau générique et (b) par l'établissement d'une classification plus "naturelle", basée sur la méthode phylogénétique. Ces objectifs ne pourront en effet pas être atteints sans les études morphologiques et taxonomiques (détection des synonymies, fixation des types etc.) de la majeure partie des taxons décrits.

Certaines espèces, dont les descriptions originales sont insuffisantes et les types inexistants, resteront cependant mal définies. Le seul moyen de lever ces incertitudes consiste en la récolte de matériel dans les localités-types lorsque celle-ci sont connues avec précision et non encore détruites par la civilisation! La récolte des insectes commensaux d'insectes sociaux n'a jamais été réputée aisée; cependant, nous pouvons dès lors recommander deux techniques nous ayant donné des résultats inespérés en Amazonie brésilienne et qui seront décrites en détail dans un travail postérieur. Il s'agit de la récolte de nids entiers de fourmis légionnaires (*Eciton* spp.) (Dégallier & Gomy 1983) et de l'utilisation d'un piège d'interception de vol ["window flight intercept trap" des auteurs anglo-saxons] (Peck & Davies 1980; Paulian 1985).

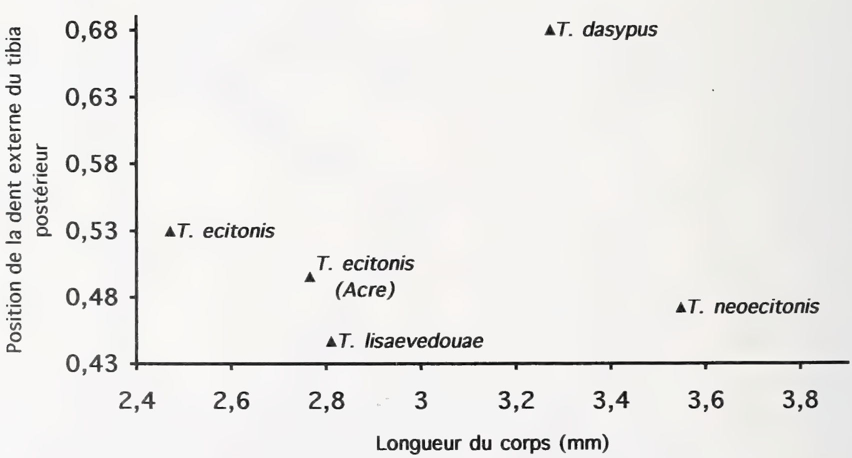

Fig. 152: Position relative de la dent externe des tibias postérieurs (rapport de la distance entre la dent et la base sur la longueur du tibia) en fonction de la longueur du corps pour 4 espèces du genre *Troglosternus*.

Remerciements

Nos plus sincères remerciements s'adressent à tous ceux qui, d'une manière ou d'une autre, nous ont aidé au long des années d'élaboration de ce travail. Conscient du risque de ne pas être exhaustif, nous citerons néanmoins (par ordre alphabétique): R. J. W. Aldridge, G. Arriagada, M. E. Bacchus, A. O. Bachmann, N. Berti, O. V. Ferreira, B. D. Gill, Y. Gomy, F. Hieke, H. F. Howden, P. Kanaar, D. H. Kistner, A. F. Newton, Jr., W. L. Overal, H. Roer, F. Schwartz, J. J. Shaw, R. I. Storey, M. Uhlig et R. L. Wenzel.

Zusammenfassung

In diesem Beitrag werden neue Ergebnisse über Stutzkäfer (Histeridae) dargestellt. Zwei Sammelmethoden waren gleichsam ertragreich: eine Flug- bzw. Fensterfalle und das Schwemmen ganzer Ameisennester. Eine neue Reinigungstechnik nach P. Kanaar wurde erfolgreich für die Präparation von Genitalstrukturen eingesetzt; dafür wurde eine basische Lösung eines proteolytischen Enzyms benutzt. Die weiblichen Genitalien von 12 Spezies von Hetaeriinae wurden zum ersten Mal beschrieben. Neue Beschreibungen, Verbreitungsangaben und ökologische Daten für 35 Spezies werden präsentiert, weitgehend basierend auf dem Studium der Typusexemplare. Die folgenden Taxa werden als neu beschrieben: *Aristonister* n. gen.; *Colonides collegii guyanensis* n. subsp.; *Neocolonides howdeni* n. gen. n. sp.; *Troglosternus neoecitonis* n. sp. Die folgenden neuen Kombinationen werden vorgeschlagen: *Aristomorphus borgmeieri, A. latipes, A. ogloblini, A. perversus, Aristonister sericeus, Hemicolonides parvulus; Latronister breyeri.* Das folgende neue Synonym wird vorgeschlagen: *Oudaimosister* Helava, in Helava et al. 1985 = *Mesynodites* Reichardt, 1924. Lectotypen und/oder Paralectotypen wurden für die folgenden Spezies designiert: *Aristomorphus borgmeieri, Aristonister sericeus, Cheilister sphaeroides, Clientister henrici, Colonides quadriglumis, Cossyphodister schwarzmaieri, Ecclisister bickhardti, Euxenister caroli, Hemicolonides parvulus, Parasynodites suturacava, Pelatetister pretiosus, Teratosoma amphiphilus, Troglosternus dasypus.* Die Gattung *Hetaeriarchus* Reichensperger wird als nomen nudum angesehen.

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Die europäischen Arten der *Cheilosia alpina*-Gruppe (Diptera, Syrphidae)

Claus Claussen

Abstract. The European species of the *Cheilosia alpina*-group (Barkalov 1983a) (Diptera, Syrphidae) are revised. The following European species are recognized and described: *Cheilosia alpina* (Zetterstedt, 1838), *Cheilosia chrysocoma* (Meigen, 1822), *Cheilosia kuznetzovae* Skufjin, 1977, *Cheilosia montana* Egger, 1860, *Cheilosia pictipennis* Egger, 1860, and *Cheilosia subpictipennis* sp. n. Four new synonyms are identified: *Cheilosia montana* Egger, 1860 = *Cheilosia braueri* (Becker, 1894) syn. n. = *Cheilosia thalhammeri* (Szilády, 1938) syn. n.; *Cheilosia pictipennis* Egger, 1860 = *Cheilosia bureschi* (Delkeskamp, 1942) syn. n. = *Cheilosia zmilampis* Violovitsh, 1975, syn. n. Lectotypes are designated for *Cheilosia alpina* (Zetterstedt, 1838), *Cheilosia phantoma* (Zetterstedt, 1838), *Cheilosia chrysocomoides* (Strobl, 1910), *Cheilosia montana* Egger, 1860, and *Cheilosia pictipennis* Egger, 1860. A key for the European species of the *Cheilosia alpina*-group, new records, and a summary of their known distribution are presented.

Key words. Diptera, Syrphidae, *Cheilosia alpina*-group, Europe, new species, new synonyms, lectotypes, distribution, key.

Einleitung

Für die sibirischen und fernöstlichen Arten der Gattung *Cheilosia* Meigen, 1822 (Eristalinae: Rhingiini) errichtete Barkalov (1983a) nach Merkmalen des Hypopygiums 8 Artengruppen: *nigripes-*, *longula-*, *illustrata-*, *alpina-*, *velutina-*, *scanica-*, *sachtlebeni-* und *formosana*-Gruppe. Die bekannten europäischen *Cheilosia*-Arten lassen sich den ersten 6 Gruppen zuordnen. Die beiden letztgenannten Gruppen sind hingegen ostpaläarktisch beziehungsweise orientalisch verbreitet.

Das Auffinden einer unbeschriebenen Art aus der *alpina*-Gruppe wird zum Anlaß genommen, deren europäische Vertreter näher zu untersuchen. Ziel der vorliegenden Arbeit ist es, die *alpina*-Gruppe zu beschreiben, durch Revision der verfügbaren Typen die gültigen Taxa für den europäischen Raum festzustellen, die Synonymie zu klären und die bislang unzureichend bekannten Arten durch Wiederbeschreibungen neu abzugrenzen.

Die verwandtschaftlichen Beziehungen der behandelten Arten untereinander und die Stellung der *alpina*-Gruppe innerhalb der Gattung sind nicht geklärt. Es scheint jedoch ein Schwestergruppenverhältnis zwischen der *alpina*-Gruppe und der *illustrata*-Gruppe (sensu Barkalov 1983a) vorzuliegen.

Die wenigen Beobachtungen zur Bionomie der besprochenen Arten lassen vermuten, daß sich die Larven als Minierer in Stengeln und/oder Wurzeln von Apiaceae oder Asteraceae entwickeln.

Material und Methode

Das untersuchte Material entstammt den folgenden Institutionen und privaten Sammlungen (vorangestellt, das im Text verwendete Kürzel): MZHF, Zoological Museum, University of

Helsinki (G. Ståhls); MZLS, Musée zoologique de Lausanne (Prof. Dr. P. Goeldlin de Tiefenau); MZLU, Lunds Universitet, Zoologiska Museet, Lund (Dr. R. Danielsson); NHMW, Naturhistorisches Museum Wien (Dr. R. Contreras-Lichtenberg); NMBA, Naturhistorisches Museum des Benediktinerstiftes Admont (Prior P. B. Hubl); SUEL, Bakonyi Természettudományi Muzeum, Zirc (Dr. S. Tóth); ZFMK, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn (Dr. H. Ulrich); ZMAN, Zoölogisch Museum Amsterdam (Dr. V. S. van der Goot & Dr. B. Brugge); ZMHB, Museum für Naturkunde der Humboldt-Universität, Berlin (Dr. H. Schumann); ZMUH, Zoologisches Museum Universität Hamburg (Prof. Dr. R. Abraham); ZSMC, Zoologische Staatssammlung München (W. Schacht); AB, Coll. Dr. A. V. Barkalov, Zoological Museum, Academy of Sciences, Novosibirsk; AM, Coll. Dr. A. Marcos-Garcia, Universidad de Alicante; AV, Coll. Dr. A. Vujić, University of Novi Sad; CC, Coll. C. Claußen, Flensburg; CK, Coll. C. F. Kassebeer, Kiel; DD, Coll. D. Doczkal, Malsch; ET, Coll. E. Torp, Jelling; FG, Coll. F. Geller-Grimm, Frankfurt/M.; FM, Coll. Dr. F. Malec, Kassel; GS, Coll. G. Schwendinger, Dornbirn; HB, Coll. H. Bartsch, Järfälla; JL, Coll. Dr. J. A. W. Lucas, Rotterdam; JS, Coll. J.-H. Stuke, Freiburg; MD, Coll. Dr. M. Daccordi, Verona; MH, Coll. M. Hauser, Darmstadt; MS, Coll. Dr. M. C. D. Speight, Dublin; PL, Coll. P.-W. Löhr, Mücke-Merlau; PR, Coll. Dr. P.-F. Röseler, Würzburg; RB, Coll. R. Borcherding, Kleinschmalkalden; RT, Coll. R. Treiber, Freudenstadt; ST, Coll. Dr. S. Tóth, Zirc; TN, Coll. Dr. T. R. Nielsen, Sandnes; UB, Coll. U. Buchholz, Freiburg; US, Coll. U. Schmid, Stuttgart; VB, Coll. V. Brădescu, Bukarest.

Die Abbildungen der Genitalstrukturen wurden nach mazeriertem Material in Glyzerin mit Hilfe einer Mikroprojektion angefertigt. Die morphologischen Termini für die Strukturen des Hypopygiums folgen weitgehend McAlpine (1981), teilweise Gaunitz (1960), abweichend davon werden jedoch die gelenkig mit dem Hypandrium verbundenen Anhänge als Gonostyli gedeutet. Abkürzungen morphologischer Termini: f = Femur, p = Bein, S = Sternit(e), T = Tergit(e), t = Tibia; sonstige Abkürzungen nach McAlpine (1981).

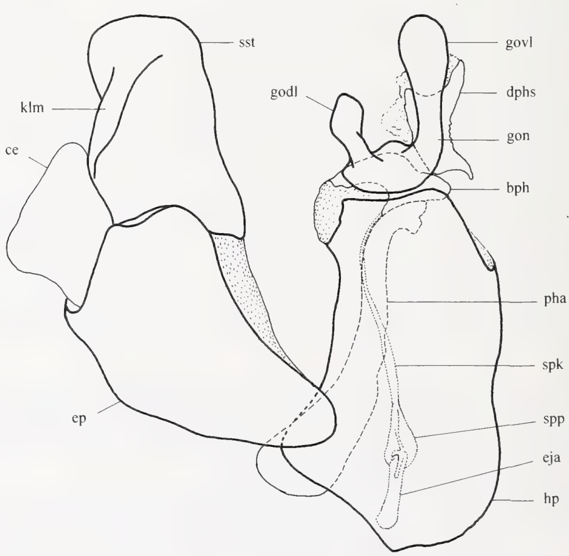


Abb. 1: *Cheilosia illustrata* (Harris, 1780), Hypopygium lateral. Abkürzungen: bph = Basiphallus, ce = Cercus, dphs = Sklerit des Distiphallus, eja = Ejakulatorapodem, ep = Epandrium, godl = dorsaler Lobus des Gonostylus, gon = Gonostylus, govl = ventraler Lobus des Gonostylus, hp = Hypandrium, klm = Kammlamelle des Surstylus, pha = Phallapodem, spk = Spermakanal, spp = Spermapumpe, sst = Surstylus.

Diagnose der *alpina*-Gruppe

♂ ♀: Mittelgroße bis große Arten (9,5—13 mm) mit breitem Abdomen und dichter, aufrechter, meist langer Körperbehaarung. Seiten des Gesichts ohne längere Haare. Augen lang behaart. Antennengruben durch einen medialen Fortsatz der Lunula getrennt. Thorax und Abdominaltergite überwiegend glänzend, schwarz bis schwarzbraun; Seiten des Scutums vor der Quernaht, Pleuren sowie das 1. Abdominaltergit höchstens mit zarter Bestäubung (*nicht* dicht weißgrau bestäubt, wie in der *illustrata*-Gruppe). Hinterrand des Scutellums und meist auch Postalarcalli ohne stärkere Borsten. Katepisternum (Sternopleuron) durchgehend lang behaart. Beine hell und dunkel gefärbt, zumindest die Spitzen der Femora und der basale Abschnitt der Tibien hell. Flügel zumeist mit mehr oder weniger deutlichem braunen Mittelfleck zwischen Subcostalzelle und Basis der Diskalmedialzelle, und zwar in beiden Geschlechtern meist deutlich bei *pictipennis* und *subpictipennis*, bei den übrigen Arten der Gruppe oft nur bei den ♀ ♀ mehr oder weniger ausgeprägt. Sternite glänzend oder von der Hinterleibsspitze zur Basis des Abdomens hin zunehmend grau bestäubt.

♂: Hypopygium: Surstyli sehr unterschiedlich: meist kurz, mit ausgeprägter Kammlamelle; zuweilen sehr stark verlängert, und dann die Kammlamelle fast vollständig fehlend (*chrysocoma*, *pictipennis*); intermediäre Ausprägungen des Surstylus finden sich bei einigen ostpaläarktischen Arten (*gorodkovi*, *nudiseta*, *subalbipila*). Ventraler Lobus des Gonostylus aufrecht, distal gelegentlich leicht nach innen gebogen (aber nicht im basalen Drittel auffällig dorsad gekrümmt wie in Abb. 16h). Die lateralen Sklerite des Distiphallus umschließen diesen kapselartig und laufen ventral in 2 basale und 2 apikale Zipfel aus.

♀: Das 3. Fühlerglied kreis-rundlich bis kurzoval, gelegentlich mit einer Oberecke (*chrysocoma*) und/oder auffällig vergrößert (*chrysocoma*, *pictipennis*, *subpictipennis*). Die Seitenfurchen der Stirn breit, nach innen bogenförmig begrenzt, zusammen etwa die Hälfte bis 2/3 der Stirnbreite einnehmend.

Die 6 folgenden Arten der *alpina*-Gruppe sind aus Europa bekannt:

Cheilosia alpina (Zetterstedt, 1838)
= *C. akela* Violovitsh, 1973
Cheilosia chrysocoma (Meigen, 1822)
= *C. phantoma* (Zetterstedt, 1838)
= *C. chrysocomoides* (Strobl, 1910)
Cheilosia kuznetzovae Skufjin, 1977
Cheilosia montana Egger, 1860
= *C. trisulcata* (Becker, 1894)
= *C. braueri* (Becker, 1894). Syn. n.
= *C. thalhammeri* (Szilády, 1938). Syn. n.
Cheilosia pictipennis Egger, 1860
= *C. innominata* (Becker in Bezzi & Stein, 1907; als Varietät von *pictipennis*)
= *C. bureschi* (Delkeskamp, 1942). Syn. n.
= *C. zmilampis* Violovitsh, 1975. Syn. n.
Cheilosia subpictipennis sp. n.
= *C. pictipennis* Barkalov in Violovitsh, 1983, nec Egger

Nach den Beschreibungen und Abbildungen in Stackelberg (1963), Peck (1971), Peck in Stackelberg & Peck (1979) und Barkalov in Violovitsh (1983) müssen auch die folgenden ostpaläarktischen Arten zur *alpina*-Gruppe gerechnet werden: *C. asiomontana* Peck, 1971, *C. balu* Violovitsh, 1966, *C. gorodkovi* Stackelberg, 1963, *C. heptapotamica* Stackelberg, 1963, *C. kaszabi* Peck in Stackelberg & Peck, 1979, *C. lutea* Barkalov, 1979, *C. nudiseta* (Becker, 1894), *C. subalbipila* Violovitsh, 1956 und *C. tibetana* Stackelberg, 1963.

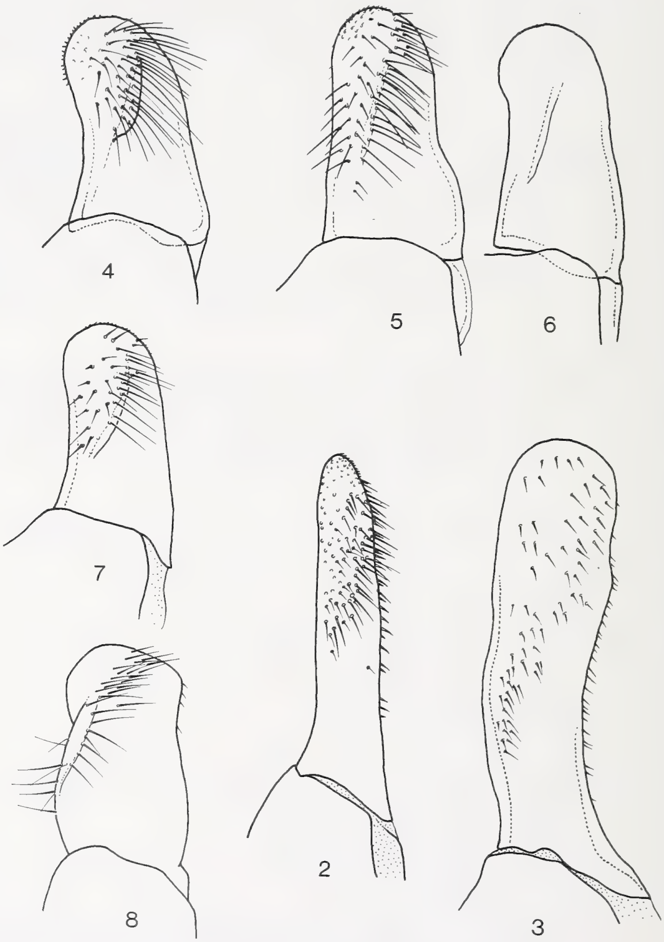


Abb. 2—8: *Cheilosia*, Surstyli lateral. — 2 *C. chrysocoma*, 3 *C. pictipennis*, 4 *C. alpina*, 5 *C. montana* (Lectotypus), 6 *C. montana* (Österreich, Alpen), 7 *C. kuznetzovae*, 8. *C. subpictipennis* sp. n.

Verwandtschaft der *alpina*-Gruppe

Die Arten der *alpina*-Gruppe stehen habituell und nach dem Bau des Hypopygiums den Arten der *illustrata*-Gruppe (sensu Barkalov 1981, 1983a) sehr nahe. Beide Gruppen besitzen kapselartig den Distiphallus umschließende, ventral in 2 basale und 2 apikale Zipfel auslaufende Distiphallussklerite, ein vermutlich synapomorphes Merkmal, das ein Schwestergruppenverhältnis (*alpina* + *illustrata*-Gruppe) wahrscheinlich erscheinen läßt. Weitere gemeinsame Grundplanmerkmale sind vermutlich: a) ein dunkler Mittelfleck zwischen Flügelstigma und Basis der Discoidalzelle, b) sehr breite, nach innen bogig verlaufende Seitenfurchen auf der Stirn der ♀♀ und c) ein auf den Seiten behaartes Gesicht. Als Autapomorphie der *illustrata*-Gruppe ist möglicherweise der nicht endständige dorsale Lobus des Gonostylus anzusehen. In der *alpina*-Gruppe werden die ventral ausgerichteten Zipfel der Sklerite des Distiphallus und der Verlust der Gesichtsbehaarung als apomorphe Gruppenmerkmale betrachtet.

Bestimmungsschlüssel für die europäischen Arten und Unterarten der *Cheilosia illustrata*- und -*alpina*-Gruppe

1. T1 lateral und Basis von T2 lateral dicht grauweiß bestäubt (bei ♀♀ deutlicher als bei ♂♂). Flügel mit braunem Mittelfleck (bei frischen Tieren gelegentlich undeutlich). 2
— T1 lateral und Basis von T2 lateral ohne dichte grauweiße Bestäubung, höchstens T1 und T2 medial schwach grau bestäubt. Flügel mit oder ohne Mittelfleck 3
2. Gesichtsseiten gewöhnlich lang behaart, selten mit nur vereinzelten langen Haaren oder ganz kahl. 3. Fühlerglied schwarz bis schwarzbraun, gelegentlich mit rötlicher Basis. Körperbehaarung auffällig dreifarbig, überwiegend fahlgelb, aber Scutum hinter der Quernaht und T3 mit mehr oder weniger vollständiger schwarzer Haarbinde, T4 und T5 mit rötlichen Haaren. .... *illustrata illustrata* (Harris)
— Gesichtsseiten unbehaart. 3. Fühlerglied rötlichbraun mit dunkler Spitze. Körperbehaarung farblich sehr variabel (Kaukasus). .... *illustrata portschinskiana* Stackelberg
3. Holoptisch: ♂♂. 4
— Dichoptisch ♀♀ 9
4. Hypopygium: Surstylus mehr als 3mal so lang wie breit (Abb. 2—3, 9—10). 5
— Hypopygium: Surstylus etwa 2mal so lang wie breit (Abb. 4—8, 11—15). 6
5. Basalhälfte von S2 auch medial mit lang abstehenden Haaren. Hypopygium: Surstylus (Lateralansicht) sich apikal verjüngend (Abb. 2). .... *chrysocoma* (Meigen)
— Basalhälfte von S2 medial ohne lang abstehende Haare oder die Haare hier kürzer und spärlicher als auf den Seiten. Hypopygium: Surstylus (Lateralansicht) apikal breit abgerundet (Abb. 3). .... *pictipennis* Egger
6. Hypopygium: Beide Loben des Gonostylus schlank und etwa gleich lang (Abb. 16e). .... *subpictipennis* sp. n.
— Hypopygium: Ventraler Lobus des Gonostylus länger und schlanker als der dorsale (Abb. 16b—d). 7
7. 3. Fühlerglied fast stets schwarz oder schwarzbraun (bei unausgefärbten Exemplaren auch rotbraun), etwa so lang wie breit, distal gerundet (Abb. 18a—b). Hypopygium: Gonostylus wie in Abb. 16b—c. 8
— 3. Fühlerglied rotbraun, etwas länger als breit (Abb. 18c). Hypopygium: Gonostylus wie in Abb. 16d (Zentralrußland). .... *kuznetzovae* Skufjin
8. Katepisternum ventral, p3-Coxen, f3 anterodorsal und S8 (Prägenitalsegment) überwiegend schwarz behaart (gilt für Tiere aus den Alpen. — Bei einzelnen Stücken aus den Karpaten und dem vorliegenden Exemplar aus Spanien ist die Behaarung deutlich heller). Flügel: cua1 schmaler oder gleich breit wie die basale Hälfte der dm (Abb. 20). Gesicht

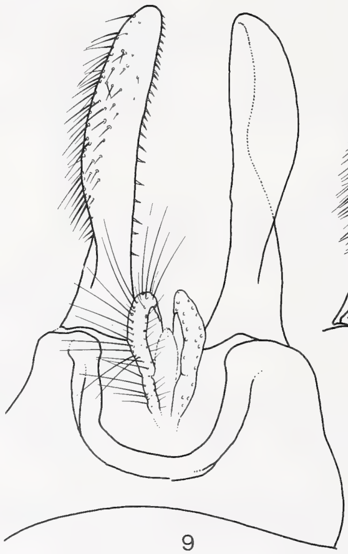
(Abb. 42) meist etwas stärker herabgezogen (variabel). Hypopygium: Kammlamelle des Surstylus (Ventralansicht) flach (Abb. 12—13). — (Alpen, Karpaten, Tatra-Gebirge, Kantabrisches Gebirge; oberhalb der Waldgrenze). .... *montana* Egger

— Katepisternum ventral, p3-Coxen, f3 anterodorsal und S8 überwiegend hell behaart, aber distales 1/4 von f3 anterodorsal mit längeren schwarzen Haaren. Flügel: cua1 etwas breiter als die basale Hälfte der dm (Abb. 22). Gesicht (Abb. 41) nicht so stark herabgezogen. Hypopygium: Kammlamelle des Surstylus (Ventralansicht) meist etwas kürzer und stärker nach außen gewölbt (Abb. 11). — (Nordskandinavien, Karelien). .... *alpina* (Zetterstedt)

9. 3. Fühlerglied höchstens 2mal so breit wie das 2. Fühlerglied, fast stets schwarz bis schwarzbraun (bei unausgefärbten Exemplaren gelegentlich heller) (Abb. 19a—b). Flügel: M1 spitzwinklig zu R4+5 verlaufend (Abb. 24). 10

— 3. Fühlerglied 2.5—3mal so breit wie das 2. Fühlerglied, für gewöhnlich hell bis düster orange (selten schwarzbraun) (Abb. 19c—f). Flügel: M1 steiler zu R4+5 verlaufend (Abb. 25, 26). 11

10. Katepisternum ventral, Scutum lateral in Höhe der Flügelwurzeln, Scutellum und Hintercoxen (anterolateral) meist mit schwarzen, selten mit ganz hellen Haaren. Distales 1/3 der f3 anterodorsal mit schräg abstehenden längeren schwarzen, selten hellen Haaren (Abb. 27). Flügel: cua1 im basalen Abschnitt schmal, nicht deutlich breiter als Basis der dm (Abb. 21). .... *montana* Egger



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10

Abb. 9—10: *Cheilosia*, Epandrium mit Surstyli und Cerci dorsal. — 9 *C. chrysocoma*, 10. *C. pictipennis*.

— Katepisternum ventral, Scutellum und Hintercoxen hell behaart. Scutum lateral nur mit vereinzelten schwarzen Haaren. Distales $^1/_3$ der f3 anterodorsal mit feinen, hellen Haaren, diese stärker aufgerichtet (Abb. 28). Flügel: cua1 im basalen Abschnitt meist breiter als Basis der dm (Abb. 23). (Abgrenzung von *montana*-♀♀ gelegentlich schwierig)... .... *alpina* (Zetterstedt)

11. Hinterrand von T5 (Dorsalansicht) gerundet (Abb. 34). 3. Fühlerglied hellorange, oft mit deutlicher Oberecke (Abb. 19e), gelegentlich (nordspanische Population) distal gebräunt und gerundet (Abb. 19e). Körperbehaarung meist auffällig dicht und fuchsrot (lichter und blasser in Populationen aus Nordskandinavien und Nordspanien). .... *chrysocoma* (Meigen)

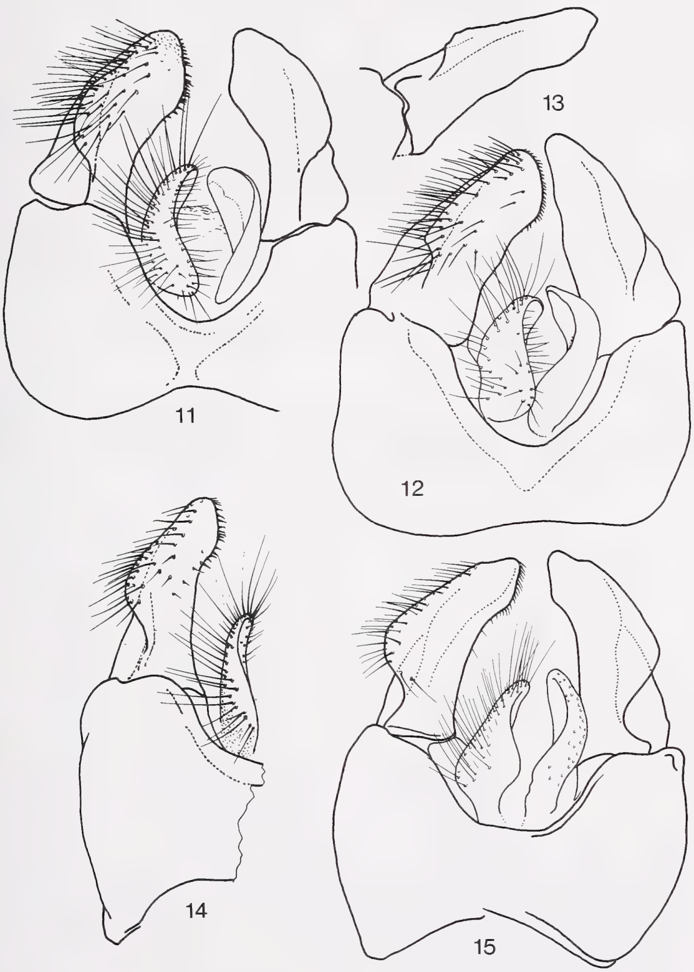

Abb. 11–15: *Cheilosia*, Epandrium mit Surstyli und Cerci dorsal. — 11 *C. alpina*, 12 *C. montana* (Lectotypus), 13 *C. montana* (Österreich, Alpen), 14 *C. kuznetzovae*, 15 *C. subpictipennis* sp. n.

— Hinterrand von T5 (Dorsalansicht) gerade abgestutzt (Abb. 36), mit den Seitenrändern nicht zu einem Bogen verbunden. 3. Fühlerglied rotorange bis braunrot (selten dunkler), mit oder ohne Oberecke (Abb. 19c, d, f). Körperbehaarung orange- bis blaßgelb, auf den hinteren Abdominaltergiten gelegentlich auch schwarz. 12

12. Relativ kürzer behaarte Art: Die abstehende Behaarung medial auf T3 deutlich kürzer als der Durchmesser des p2-Basitarsus; Behaarung auf dem Scutellum wie geschoren, kürzer als Durchmesser der f3. Basale Hälfte der f3 anteroventral mit vereinzelten längeren, abstehenden Haaren, die kürzer sind als der Durchmesser von f3 (Abb. 31). Apikales $^1/_3$ der f3 anteroventral hell behaart, gelegentlich mit vereinzelten kurzen schwarzen Börstchen. .... *kuznetzovae* Skufjin

— Relativ länger behaarte Arten: Die abstehende Behaarung medial auf T3 deutlich länger als Durchmesser des p2-Basitarsus; Behaarung auf dem Scutellum struppig abstehend und länger als der Durchmesser der f3. Basale Hälfte der f3 anteroventral und apikale Hälfte der f3 anterodorsal mit langen, abstehenden Haaren, diese deutlich länger als Durchmesser von f3 (Abb. 29—30). Apikales $^1/_3$ der f3 anteroventral mit kurzen hellen und schwarzen Haaren (variabel). 13

13. Behaarung der basalen Hälfte von S2 medial schmal unterbrochen oder hier kürzer als an den Seiten; Haare auf der basalen Hälfte von S3 medial meist niedergedrückt. Die kurze Behaarung auf der Ventralseite von f3 annähernd gleich lang und durchschnittlich kürzer als $^1/_3$ des Durchmessers von f3 (Abb. 30). .... *pictipennis* Egger

— Behaarung der basalen Hälfte von S2 medial nicht unterbrochen und hier meist deutlich länger als an den Seiten. Haare auf der basalen Hälfte von S3 auch in der Mitte aufrecht (oft aber nur in einem schmalen Saum). Die kurzen Haare auf der Ventralseite von f3 ungleich lang und zumeist länger als $^1/_3$ des Durchmessers von f3 (Abb. 29). (Die Abgrenzung von *pictipennis*-♀♀ gelegentlich schwierig). .... *subpictipennis* sp. n.

Beschreibung und Diskussion der Arten

Cheilosia alpina (Zetterstedt, 1838)

Eristalis alpina Zetterstedt, 1838; Ins. Lapp.: 611; loc. typ.: Schwedisch Lappland: Jockeltind.
Cheilosia akela Violovitsh, 1973; Trudy Biol. Inst., Sib. Otd. Akad. Nauk SSSR: 145; loc. typ.: Westsibirien: Altai (Synonymie durch Barkalov 1983b: 633).

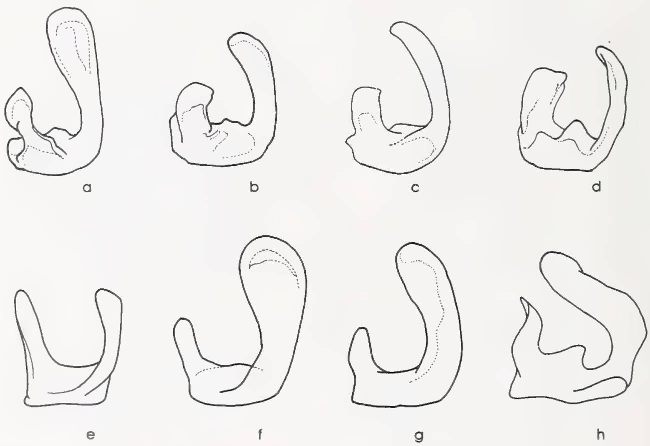

Abb. 16 a—h: *Cheilosia*, Gonostyli lateral. — a *C. illustrata*, b *C. alpina*, c *C. montana* (Lectotypus), d *C. kuznetzovae*, e *C. subpictipennis* sp. n., f *C. chrysocoma*, g *C. pictipennis*, h *C. barbata*.

Typen: *Eristalis alpina* Zetterstedt: Lectotypus ♂, hiermit festgelegt. Etikettierung: „*E. alpina* ♂. Jockelt.“, in Dipt. Scand. Coll. MZLU. Erhaltungszustand: Vollständig und gut erhalten. — Paralectotypen: 1 ♂ „*E. alpina* ♂. Jockeltind“, in Ins. Lapp. Coll. MZLU; 1 ♀ „*E. alpina* ♀. Jockelt.“, in Dipt. Scand. Coll. MZLU; 1 ♂ ohne Daten, in Dipt. Scand. Coll. MZLU. In der Sammlung Zetterstedt befinden sich die vier oben aufgeführten Exemplare, die als Syntypen aufgefaßt werden. Lectotypus und Paralectotypen wurden entsprechend etikettiert.

Weiteres Material: Schweden: 1 ♂, L. Brundin leg., Torne Lappmark, Abisko, 1928 (ET). 1 ♂, J. Struve leg., Torne Lappmark, Gällivare, Kakerjaure RN1610/7502, 29. 6. 1982 (HB). 2 ♂♂, S. Gaunitz leg., Lappland, Sorsele (weitere Angaben unleserlich), 30. 7. 1929 (MZLU). 1 ♀, S. Gaunitz leg., Ly Lpm. (= Lycksele Lappmark), Ammarnäs, 26. 7. 1971 (MZLU). Norwegen: 1 ♂, T. R. Nielsen leg., STJ, Oppdal, Kongsvoll EIS 79, 24. 6. 1988 (TN); 1 ♂ gleicher Fundort, 26. 6. 1988 (TN); 2 ♂♂ gleicher Fundort, 27. 6. 1988 (TN/CC); 1 ♂, Arne Nielsen leg., Kongsvoll STI, Oppdal, 18. 7. 1966 (TN); 1 ♀, T. R. Nielsen leg., Spiterstulen On: Lom, 1. 7. 1974 (CC). Russische Föderation: 14 ♂♂ 3 ♀♀, Mikkola, Hippa & Jalava leg., SW-Altai, 15 km S Katanda, Bert-Kum, 2000–2500 m, 10.–14. 7. 1983 (MZHF).

Verbreitung: Norwegen, Schweden, Finnland (Frey 1941), Russische Föderation: Karelien, Nordwest-Sibirien (Stackelberg 1970), östlich bis zum Baikalsee, Altai-Gebirge. Mongolei (Peck 1977). — Zu dem Nachweis aus Nordspanien (Marcos-Garcia 1989) siehe unter *C. montana*!

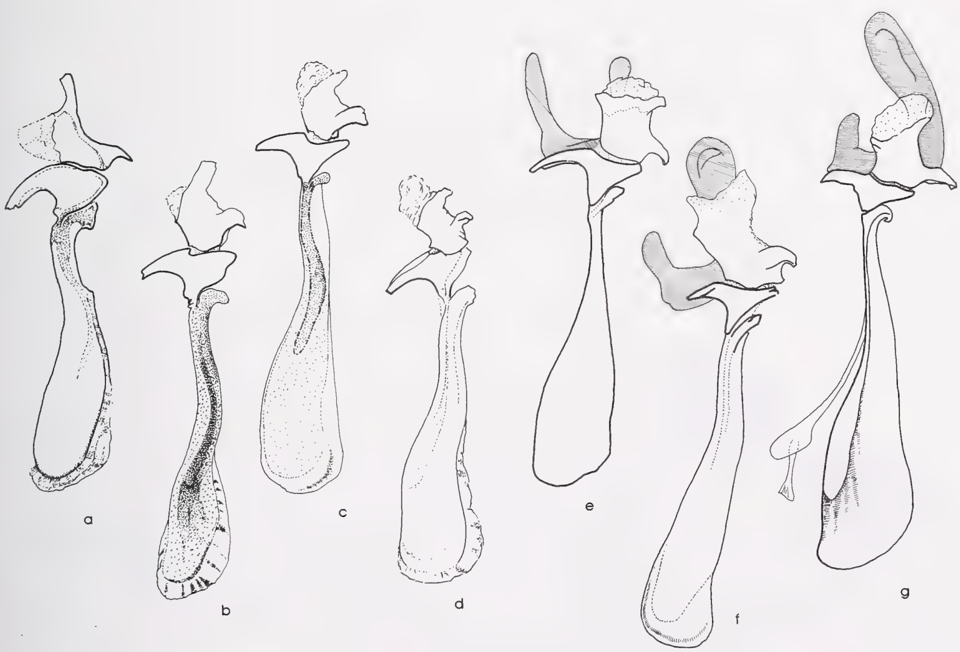

Abb. 17 a–g: *Cheilosia*, Aedoeagus mit Phallapodem, lateral, e–f mit Gonostylus (schraffiert). — a *C. illustrata*, b *C. alpina*, c *C. montana*, d *C. kuznetzovae*, e *C. subpictipennis* sp. n., f *C. chrysocoma*, g *C. pictipennis*.

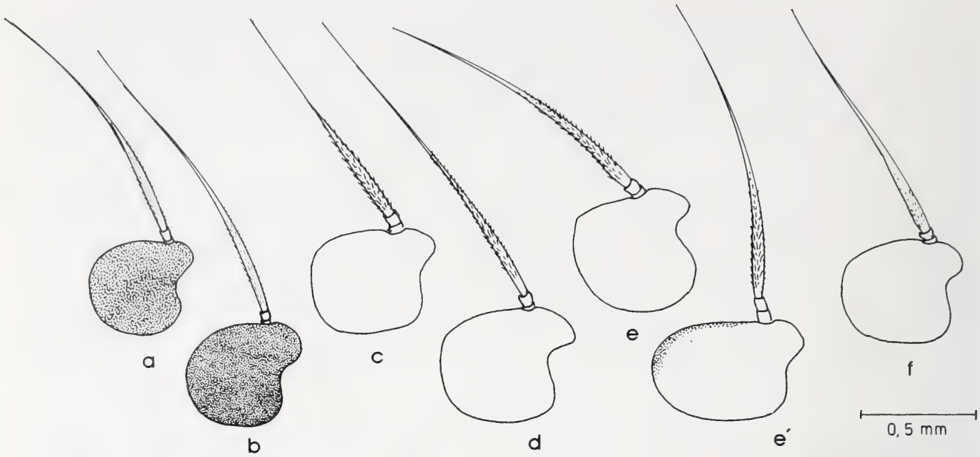

Abb. 18 a—f: *Cheilosia* ♂♂, drittes Glied des linken Fühlers mit Arista von außen. — a *C. alpina*, b *C. montana*, c *C. kuznetzovae*, d *C. subpictipennis* sp. n., e *C. chrysocoma* (Mitteleuropa), e' *C. chrysocoma* (Nordspanien), f *C. pictipennis*.

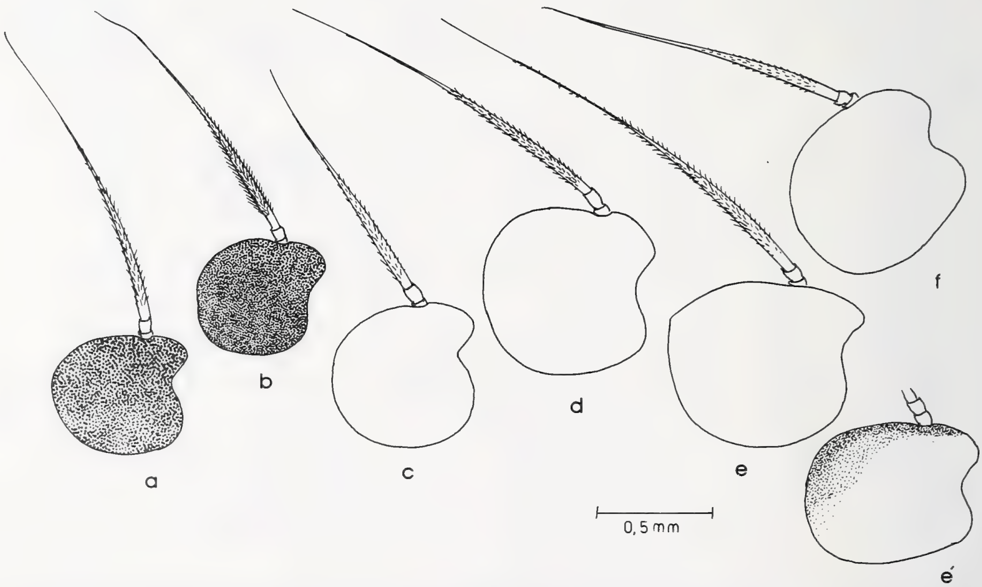

Abb. 19 a—f: *Cheilosia* ♀♀, drittes Glied des linken Fühlers mit Arista von außen. — Zuordnung der Arten wie in Abb. 18.

Beschreibung

Diagnose: Morphologisch sehr ähnlich *montana*; Gesicht (Abb. 41) meist etwas stärker vorspringend und weniger weit herabgezogen; Flügel: cua1 im basalen Abschnitt meist etwas breiter als der entsprechende Abschnitt der dm. Körperbehaarung insgesamt heller als bei *montana*, Katepisternum ventral ohne schwarze Haare.

♂: Körper schwarz bis dunkel-olivbraun, fein punktiert. Kopf (Abb. 41): Stirn mit deutlicher Mittelfurche, nur an den Augenrändern schmal grau bestäubt, lang schwarz behaart, selten mit einzelnen hellen Haaren vermischt. Gesicht ausgedehnt graugelb bestäubt, seitlich über dem Mundrand schwarz glänzend. Wangen (Genae) wenig breiter als das 2. Fühlerglied, oben wie das Gesicht bestäubt und hell behaart, nach unten hin stärker glänzend und zunehmend auch mit schwarzen Härchen. Scheitel lang schwarz oder schwarz und hell behaart. Fühler (Abb. 18a) schwarz, bei unausgefärbten Stücken rötlichbraun, 3. Fühlerglied im Umriß etwas variabel: meist distal gerundet, aber gelegentlich auch mit undeutlicher Oberecke; Arista fast nackt. Lunula gelblich bis bräunlich. Augen lang hell behaart.

Thorax: Behaarung des Scutums ungleich lang, abstehend graugelb bis fuchsrot, zwischen den Flügelwurzeln eine mehr oder weniger ausgeprägte schwarze Haarbinde, die sich seitlich craniad in die helle Behaarung hineinziehen kann. Scutellum ganz oder überwiegend hell behaart, median gelegentlich mit kürzeren schwarzen Haaren. Behaarung der Pleuren überwiegend hell, meist etwas blasser als auf dem Scutum, aber Anepisternum, Anepimeron und dorsale Hälfte des Katepisternums in unterschiedlicher Ausdehnung auch mit schwarzen Haaren; ventraler Abschnitt des Katepisternums hell behaart (Unterschied zu typischen *montana*). — Flügel (Abb. 22) ohne deutliche dunkle Querbinde, aber an den Queradern r-m

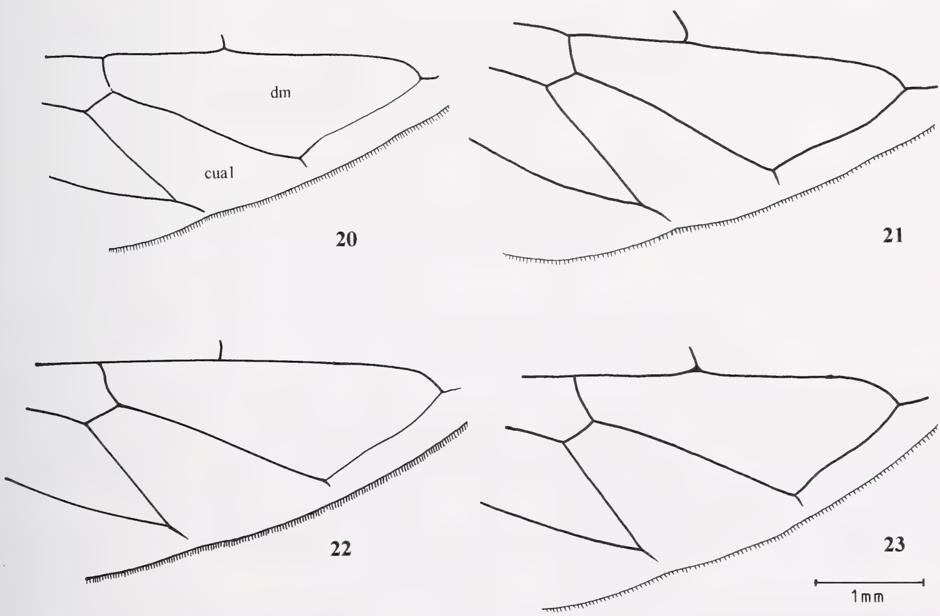

Abb. 20—23: *Cheilosia*, Flügelausschnitt. — 20 *C. montana* ♂, 21. *C. montana* ♀, 22 *C. alpina* ♂, 23 *C. alpina* ♀ (dm = Discalmedialzelle, cua1 = vordere Cubitalzelle).

und m-cu oft auffällig gebräunt, cua1 etwas breiter als basale Hälfte von dm (relativ konstanter Unterschied zwischen skandinavischen *alpina*- und alpinen *montana*-Populationen). Squamulae weißlich, Saum gelblich; Halteren gelbbraun mit dunklem Köpfchen. — Beine: Femora schwarz, apikal sehr schmal gelblich; Tibien im basalen 1/3 und apikal schmal gelbbraun, mit zwischenliegendem schwarzem Ring (gelegentlich undeutlich); Tarsen, bis auf die beiden basalen Glieder der p2, dorsal geschwärzt, ventral oft heller. Behaarung der Beine variabel, gelblich und schwarz (insgesamt aber deutlich heller als bei *montana*): f3 überwiegend hell behaart, nur ventral mit schwarzen Borsten und in der apikalen Hälfte anterolateral sowie im apikalen 1/3 auch anterodorsal mit schwarzen Haaren. p3-Coxa überwiegend hell behaart, nur apikaler Zipfel mehr oder weniger schwarzhaarig.

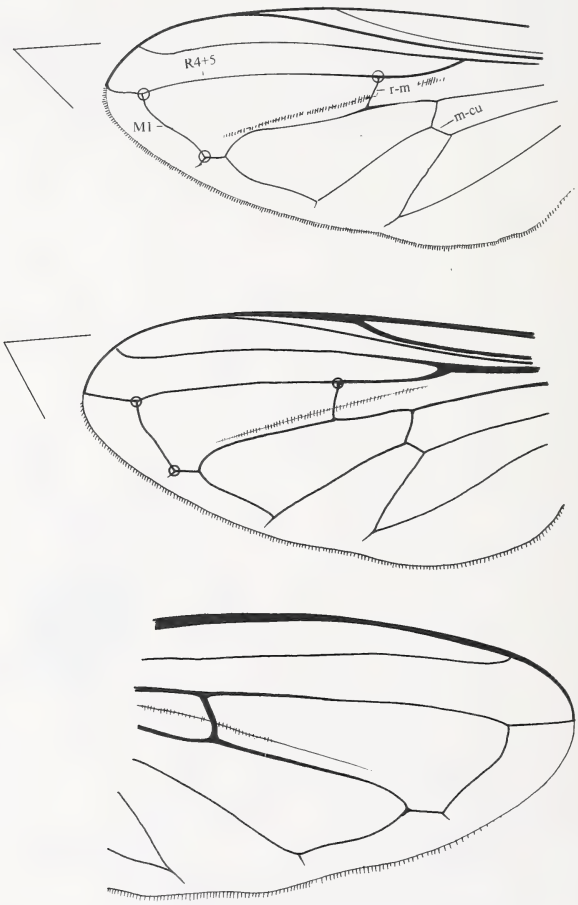

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Abb. 24—26: *Cheilosia*, Flügelausschnitt. — 24 *C. montana* ♀, 25 *C. subpictipennis* sp. n. ♀, 26. *C. kuznetzovae* ♀ (Winkel in Abb. 24 und 25 vgl. Text).

Abdomen: Kurz und breit, überwiegend glänzend, T2 (und T3) medial matt: T1—4 lang abstehend rötlich bis blaßgelb behaart, Hinterecken von T2—4 gelegentlich mit einzelnen schwarzen Haaren. S1—2 sowie Seiten von S3—4 lang abstehend hell behaart; S3 medial mit kurzer, schräg abstehender heller oder heller und schwarzer Behaarung, auf S4 sind diese kurzen Haare überwiegend schwarz. Hinterrand von S4 auch mit längeren schwarzen Haaren. S8 (Prägenitalsegment) meist überwiegend hell behaart. — Hypopygium (Abb. 4, 11, 16b, 17b): Sehr ähnlich wie bei *montana*, aber Kammlamelle des Surstylus (Abb. 11) zumeist etwas kürzer und stärker nach außen gewölbt.

Maße: Körper 9,7—11,7 mm; Flügel 8,5—10,0 mm.

♀: Bis auf die üblichen Geschlechtsunterschiede dem ♂ sehr ähnlich, aber die schwarze Körperbehaarung und die dunkle Färbung der Beine reduziert. Kopf (Abb. 40) hell behaart, nur am unteren Augenrand mit ganz vereinzelten schwarzen Haaren. Seitenfurchen der Stirn grob punktiert und mit leicht bogenförmiger Runzelung, an ihrer breitesten Stelle zusammen $^1/_2$—$^2/_3$ der Stirnbreite einnehmend. Fühler (Abb. 19a) schwarz, die beiden basalen Glieder und Basis von Glied 3 gelegentlich rötlichbraun; 3. Glied apikal gerundet, gelegentlich mit Andeutung einer Oberecke.

Thorax: Hell behaart, gelegentlich Seiten des Scutums vor der Quernaht und neben den Flügelwurzeln mit vereinzelten schwarzen Haaren; Pleuren lang und fein hell behaart, ohne schwarze Haare. — Flügel (Abb. 23): Basalhälfte von cua1 meist deutlich breiter als dm. — Beine überwiegend hell behaart, nur Tarsen in unterschiedlicher Ausdehnung mit kurzen schwarzen Härchen und Borsten sowie f1 und f2 im apikalen $^1/_3$ posteroventral und f3 im apikalen $^1/_3$ anteroventral mit schwarzer und heller Behaarung. Die anterodorsale Behaarung auf f3 (Abb. 28) hell (bei *montana* zumindest teilweise schwarz). Hintercoxen hell behaart (bei *montana* zumindest anterolateral meist mit schwarzen Haaren).

Abdomen: Tergite glänzend, nur Basis von T2 medial matt, ohne schwarze Haare.

Maße: Körper 9,5—10,5 mm; Flügel 8,7—9,0 mm.

Variabilität: Nach dem vorliegenden Material variiert die Art in Nordeuropa kaum. Bei den Tieren aus dem Altai-Gebirge ist im Flügel die Weite der cua1 im Verhältnis zur Weite von dm deutlich variabler als in europäischem Material, so daß sich hier bezüglich dieses Merkmals die Unterschiede zu *montana* verwischen.

Präimaginalstadien: nicht beschrieben.

Cheilosia chrysocoma (Meigen, 1822)

Syrphus chrysocomus Meigen, 1822; Syst. Beschr. 3: 280; loc. typ.: ? Stolberg bei Aachen.

Eristalis phantoma Zetterstedt, 1838; Ins. Lapp.: 611; loc. typ.: Norwegen: Raschstind, an der Mündung des Malangerfjordes.

Chilosia chrysocomoides Strobl, 1910; Mitt. naturw. Ver. Steierm. 46: 101; loc. typ.: Österreich: Steiermark, Admont.

Typen: *Syrphus chrysocomus* Meigen: Typen nicht untersucht. Von den ursprünglich vier Syntypen befindet sich noch 1 ♀ in Coll. Meigen (Paris), das zweifelsfrei zu der vorliegenden Art gehört (M. C. D. Speight briefl., siehe auch Becker 1902).

Eristalis phantoma Zetterstedt: Lectotypus ♂, hiermit festgelegt. Etikettierung: „*E. Phantoma* ♂. Raschstind.“, in Dipt. Scand. Coll. MZLU. Erhaltungszustand: Arista des rechten Fühlers fehlt. — Paralectotypen: 1 ♂ „*E. Phantoma* ♂ Raschstind“, in Ins. Lapp. Coll. MZLU; 1 ♂ „Dovre“, darüber zwei kleine, rechteckige Zettel ohne Angaben, in Dipt. Scand. Coll. MZLU.

Chilosia chrysocomoides Strobl: Lectotypus ♂, hiermit festgelegt. Etikettierung: „Admont Steierm. Strobl.“, in Coll. Strobl NMBA. Erhaltungszustand: Sehr gut. — Paralectotypus 1 ♀ mit denselben Angaben wie der Lectotypus, in Coll. Strobl NMBA. — Der Lectotypus ist ein frisches Exemplar von *chrysocoma*. Der Paralectotypus ist ein unausgefärbtes Exemplar

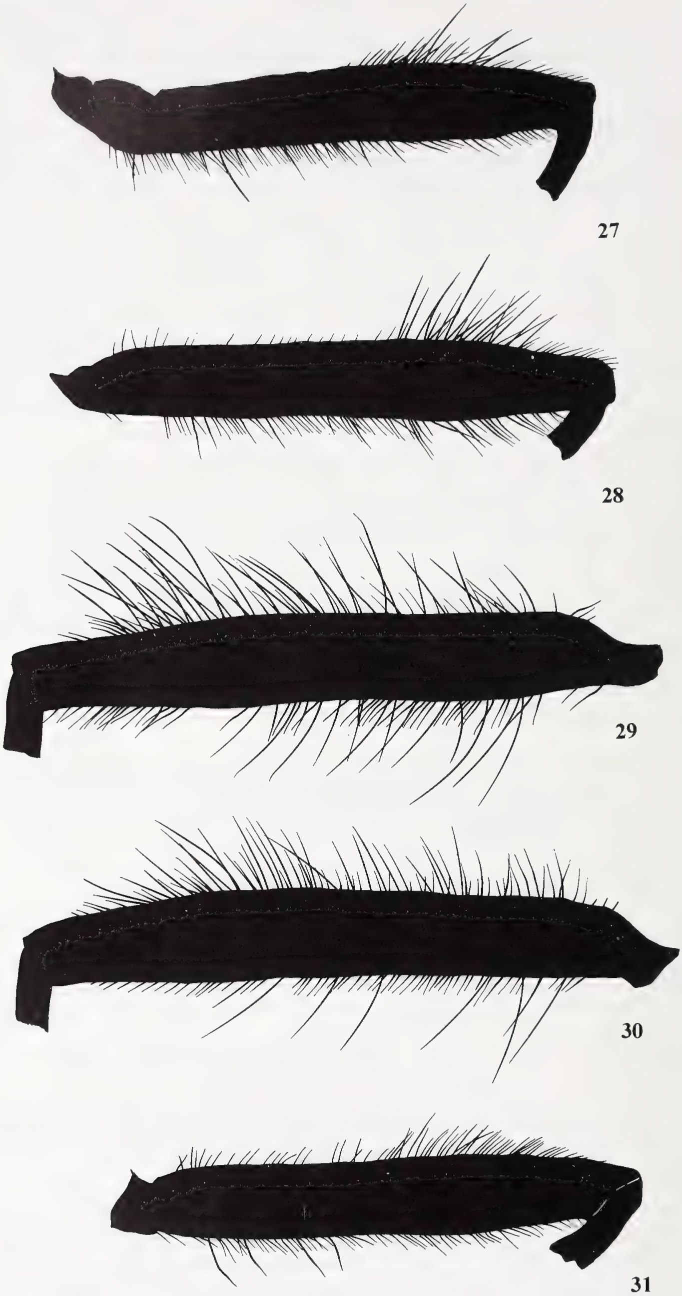


Abb. 27—31: *Cheilosia* ♀♀, f3 lateral von vorn . — 27 *C. montana*, 28 *C. alpina*, 29 *C. subpictipennis* sp. n., 30 *C. pictipennis*, 31 *C. kuznetzovae*.

von *pictipennis*, mit fehlender Flügelbinde und langer schwarzer Behaarung am Hinterrand von T2 und auf T3—5. Lecto- und Paralectotypen wurden als solche etikettiert.

Weiteres Material: Schweden: 1 ♀, J. A. W. Lucas leg., Torne Lappmark, Abisko, 485 m, 5. 7. 1980 (JL); 1 ♀, Jeekel en Piet leg., Torne Lappmark, Abisko, 10. 7. 1955 (ANZM); 1 ♀, D. Gaunitz leg., Lappmark, Sorsele, 13. 7. 31 (MZLU). Norwegen: 1 ♀, T. R. Nielsen leg., Åstereit, HOy: Åsane, 30. 5. 1971 (CC); 1 ♂, A. Fjelberg leg., HOy: Fana, 1. 6. 1968 (CC); 2 ♂♂, T. R. Nielsen leg., Isdalen, HOy: Bergen, 1. 6. 1963 (ZMAN/CC); 3 ♂♂, J. A. W. Lucas leg., STI: Uppdal, Kongsvall, 4. 7. 1977 (JL); 1 ♂, J. A. W. Lucas leg., By: Hoi, Hangastøl, 1150 m, 6. 7. 1976 (JL). Irland: 1 ♂, M. C. D. Speight leg., N-4060 Ballynafid L. Co. Westmeath, 6. 5. 1985 (CC); 1 ♀, M. C. D. Speight leg., NR. Slane, Louth, 7. 6. 1971 (CC). Niederlande: 1 ♂ 2 ♀♀, B. v. Aartsen leg., Limbricht, 23. 4. 1972 (JL); 1 ♂, V. S. van der Goot leg., Echt De Dort, 5. 5. 1970 (ZMAN); 1 ♀, v. Doesburg leg., Baarn Utr., 6. 5. 1947 (ZMAN); 1 ♀, J. A. W. Lucas leg., Ulvenhout, 12. 5. 1969 (JL); 1 ♀, V. S. van der Goot leg., Bunder Bos, 16. 5. 1970 (ZMAN); 1 ♂, V. S. van der Goot leg., Rijckholt, Savelsbos, 25. 5. 1970 (ZMAN). Belgien: 1 ♂ Hohes Venn bei Sourbrodt, 25. 4.—3. 5. 1957 (ZFMK); 1 ♂, Br. Arnoud leg., Rekum, 12. 4. 1950 (ZMAN). Polen: 1 ♂ (Schlesien) „Wölfelsfall 17/5 26513", „Original v. Becker" (ZMHB). Deutschland: 1 ♂ Hint. Sächsische Schweiz, Gr. Winterberg, S-Kuppe, 420—490 m, 5. 5. 1968 (ZMAN); 1 ♂ Bayr. Alpen, Leitzachtal, 14. 4. 1946 (ZSMC); 1 ♂, K. Kormann leg., Grötzingen, 21. 4. 1975 (CC); 1 ♂ Straussdorf bei Ebersberg, 26. 4. 1969 (JL); 1 ♀, F. Stöcklein leg., Starnberger-Seegebiet, Haarkirchen-Mautal, 30. 4. 1941 (ZSMC); 1 ♂, Stöck. leg., Starnberg a. See, Würmtal, Petersbrunn, 9. 5. 1975 (JL); 1 ♀, Dr. v. Rosen leg., Wolfratshausen, 11. 5. 19. (ZSMC); 1 ♀, F. Malec leg., 800 m nö Silberborn NC33, 30. 6. 1987 (FM); 1 ♂, Weiffenbach leg., Mittelhessen, Lahntal zwischen Gießen und Marburg, 20. 4. 1983 (ZSMC); 1 ♂, A. Haas leg., Münster Sentmaring Park, 23. 5. 1953 (ZSMC); 1 ♀, H. Ulrich leg., Südwestdeutschland, Ottmarsheim, 22. 4. 1957 (ZFMK); 1 ♀, R. Rombach leg., Eifel, Genfbachtal bei Nettersheim, 18. 6. 1987 (ZFMK). Österreich: 1 ♂ „Austria", „Egger 1866" (NHMW). Schweiz: 1 ♂, A. Aptroot leg., Berner Oberland, Grindelwald, 1000 m, 22. 5. 1982 (ZMAN). Italien: 1 ♀, J.-H. Stuke leg., Südtirol, Vinschgau: Planeiltal, 1800—2000 m, 27. 6. 1992 (JS). Ungarn: 1 ♂, S. Tóth leg., Tihany: Csucshegy, 17. 4. 1983 (CC); 1 ♂, S. Tóth leg., Tihany: Kiserdó tetó M-cs., 26. 4. 1983 (SUEL); 1 ♂ 1 ♀, S. Tóth leg., Hárskut: Esztergáli-völgy, 13. 5. 1983 (SUEL). Jugoslawien/Serbien: 1 ♂, A. Vujić leg., Fruška Gora, Vrdnik, 22. 4. 1988 (CC). Spanien: Kantabrisches Gebirge: 4 ♂♂ 3 ♀♀, V. S. van der Goot & J. A. W. Lucas leg., Oviedo or Leon, Puerto de Pajares, 1350—1700 m, 11.—18. 7. 1972 (JL).

Verbreitung: Weite Teile Europas und Sibiriens: Norwegen und Schwedisch Lappland bis Nordspanien, Norditalien (Südtirol), Serbien, Rumänien (Brădescu 1991); von Irland über Mitteleuropa, die Taiga- und Waldgürtel des europäischen Rußland (Stackelberg 1970) und Westsibirien bis zum Baikalsee (Violovitsh 1983).

Beschreibung (mitteleuropäische Exemplare)

Diagnose: Sehr dicht und auffällig fuchsrot behaart (siehe aber unten: „Variabilität"); 3. Fühlerglied (Abb. 18e, 19e) leuchtend blaßorange. ♂: Surstylus stark verlängert und apikal verjüngt (Abb.2, 9). ♀: Hinterrand von T5 gerundet (Abb. 34).

♂: Kopf (Abb. 35): Stirn lateral grau bestäubt mit deutlicher Mittelfurche, abstehend blaßgelb behaart. Gesicht schwarz, zart grau bestäubt; Mittelhöcker und ein Dreieck über dem seitlichen Mundrand glänzend. Wangen (Genae) etwas breiter als das 2. Fühlerglied und wie Augen, Scheitel und Occiput fein hell behaart. Fühler (Abb. 18e): Gestalt etwas variabel, oft (aber nicht konstant) mit deutlicher Oberecke, Arista zart, dunkel, fast nackt. Lunula und 2 Grundglieder der Fühler hell.

Thorax: Scutum und Scutellum fuchsrot, sehr dicht und mäßig lang abstehend behaart, selten vereinzelte schwarze, borstenförmige Haare neben der Flügelwurzel. Pleuren (Episternum und Epimeron) zart bestäubt und lang blaßgelb behaart. — Flügel: Adern der basalen Flügelhälfte gelblich, distal dunkler; r-m und m-cu meist etwas stärker gebräunt, gelegentlich

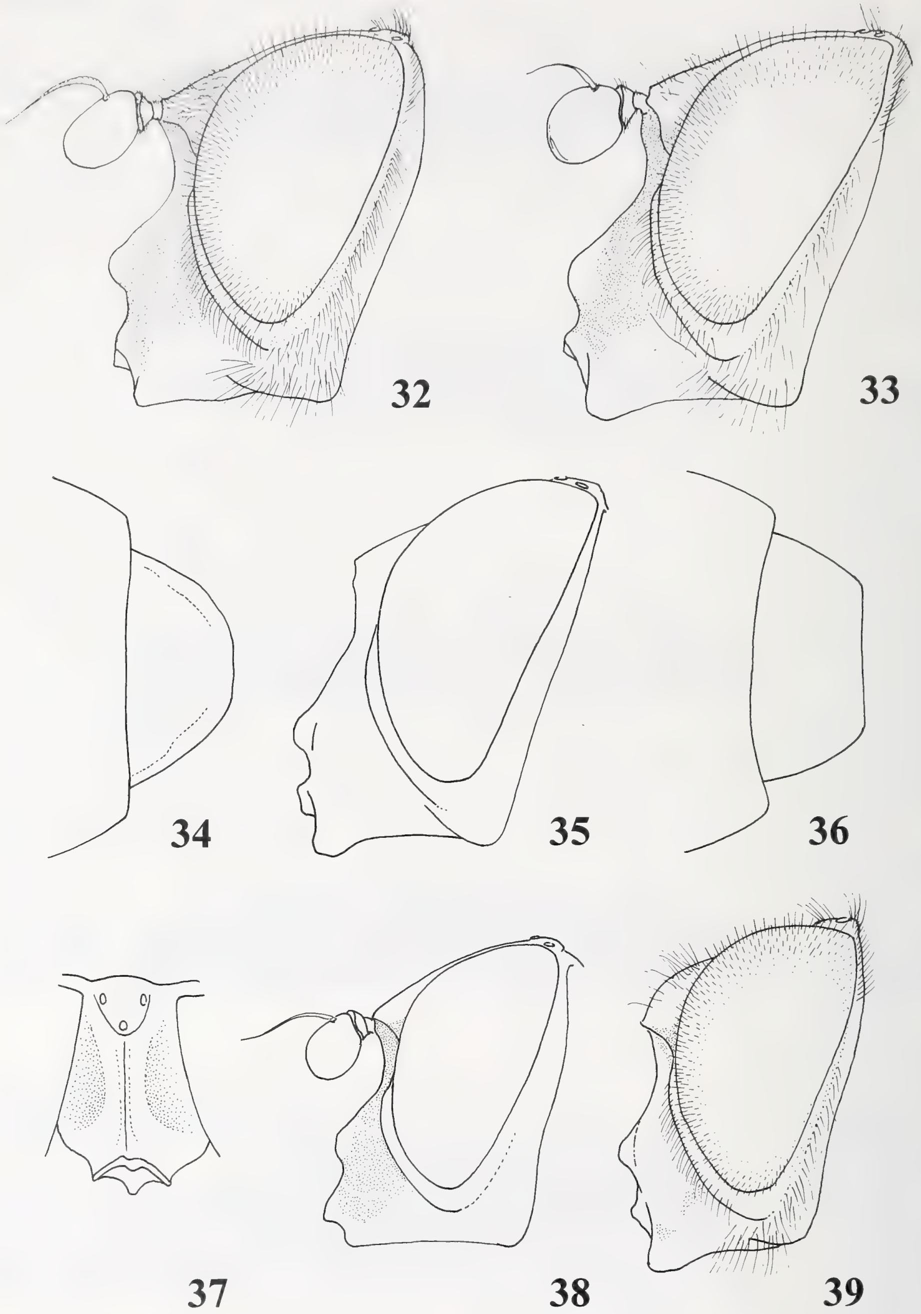
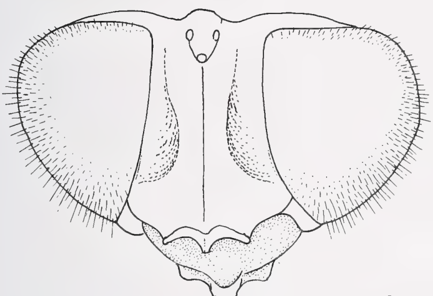


Abb. 32—39: *Cheilosia*. — 32 *C. pictipennis* ♀, Kopf lateral, 33 *C. subpictipennis* sp. n. ♀, Kopf lateral, 34—35 *C. chrysocoma*: 34 ♀, Tergite 4—5 dorsal, 35 ♂, Kopf lateral (ohne Behaarung und Bestäubung); 36 *C. subpictipennis* sp. n. ♀, Tergite 4—5 dorsal, 37—39 *C. kuznetzovae*: 37 ♀, Stirn dorsal, 38 ♀, Kopf lateral (ohne Behaarung), 39 ♂, Kopf lateral.

auch die angrenzende Flügelfläche bräunlich. Squamulae weißlich, Saum rötlich; Halteren orange, bisweilen Köpfchen etwas dunkler. — Beine: Femora schwarz mit heller Spitze; Tibien hellorange mit undeutlicher, blaßbrauner Binde, meist überwiegend hell behaart, aber auch mit einzelnen schwarzen Haaren vermischt; Tarsen mit Ausnahme der Endglieder hell, aber p1-Tarsen und p3-Basitarsus dorsal geschwärzt.

Abdomen: T2—4 dicht und lang abstehend fuchsrot behaart, selten Hinterecken von T3 und T4 mit vereinzelten schwarzen Haaren. S1 grau bestäubt; S2—4 glänzend; Behaarung auf S1—2 sowie lateral auf S3—4 abstehend blaßgelb; S3—4 medial mit kurzen, anliegenden Haaren, die caudad zunehmend mit schwarzen Härchen vermischt sein können. — Hypopygium (Abb. 2, 9, 16f, 17f): Surstylus sehr stark verlängert und apikal verjüngt.

Maße: Körper 9,3—11,6 mm; Flügel 8,3—10,0 mm.



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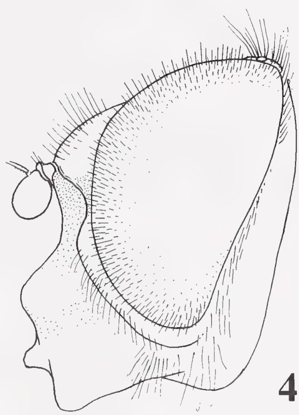

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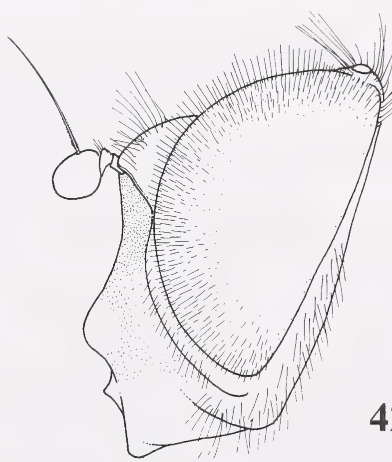

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Abb. 40—43: *Cheilosia*, Köpfe. — 40 *C. alpina* ♀ dorsal, 41 *C. alpina* ♂ lateral, 42 *C. montana* ♂ lateral (Alpen), 43 *C. montana* ♂ lateral (Kantabrisches Gebirge, ohne Behaarung und Bestäubung).

♀: Dem ♂ sehr ähnlich, aber etwas kürzer und dichter behaart. Kopf: Gesicht etwas weniger bestäubt; Stirn mit schwacher Mittelfurche und den für die Gruppe typischen, sehr breiten Seitenfurchen. Fühler (Abb. 19e) hellorange, das 3. Glied oft mit deutlicher Oberecke, gelegentlich auch distal gerundet.

Thorax: Scutum und Scutellum sehr dicht und gleichmäßig fuchsrot behaart, neben den Flügelwurzeln und gelegentlich auch auf den Postalarcalli einzelne schwarze Borsten. — Flügel: M1 steiler als beim ♂ in R4+5 mündend. — Beine: Tibien heller als beim ♂, oft ohne dunkle Binden.

Abdomen: Kurzoval, der Hinterrand von T5 gerundet (Abb. 34); T2—3 lang abstehend fuchsrot behaart; auf T4—5 wird die Behaarung caudad allmählich länger und blasser.

Maße: Körper 10,2—12,0 mm; Flügel 9,1—10,3 mm.

Variabilität: Die Art variiert in Mitteleuropa farblich kaum. In Mittelnorwegen und Mittelschweden treten zunehmend Exemplare auf, die sich durch blassere (graugelbe) und etwas weniger dichte Behaarung, dunkle Tibienbinden und ausgeprägten Flügelfleck von mitteleuropäischen Vertretern unterscheiden; sie entsprechen dem Konzept von *phantoma* (Zetterstedt, 1838). Die vorliegenden Exemplare aus Irland sind kupferrot behaart, und damit etwas dunkler als kontinentale Vertreter. Bei dem ♀ zeigt sich außerdem eine scharfe Grenze zwischen der kupferroten, gleichlangen Behaarung auf T2—3 und der blaßgelben, deutlich längeren und struppigeren Behaarung auf T4—5. In diesen Merkmalen scheinen sich nach Verrall (1901: 239) auch die englischen von kontinentalen Exemplaren zu unterscheiden. Aus Nordspanien (Kantabrisches Gebirge) liegt eine Serie vor, die durch ihre blasse und lockere Körperbehaarung den nordskandinavischen Populationen ähnelt. Die spanischen Exemplare unterscheiden sich außerdem durch eine etwas kürzere Körperbehaarung, die Reduktion der schwarzen Borsten an den Seiten des Scutums und durch das etwas schlankere, dorsal geschwärzte und distal gerundete 3. Fühlerglied (Abb. 18é, 19é) (siehe auch Marcos-Garcia 1989).

Präimaginalstadien: Die Larve von *C. chrysocoma* soll nach Batra et al. (1981) in den Blattrosetten („crowns") und Stengeln von *Carduus nutans* (Asteraceae) minieren. Eiablagen konnten in Süddeutschland, Baden-Württemberg, am 11. Mai, an *Angelica sylvestris* (Apiaceae) beobachtet werden, wobei die Eier einzeln oder in großem Gelege unter eine Blattscheide an der Stengelbasis plaziert wurden (Doczkal 1996).

Cheilosia kuznetzovae Skufjin, 1977

Cheilosia kuznetzovae Skufjin, 1977; Novye i maloizvestnye vidy nasekomykh Evropeiskoi chasti SSSR, Leningrad: 57—60; loc. typ.: Rußland: Lipetsker Region, Galichya Gora.

Typen: Designierte Typen wurden nicht untersucht. Die Daten des vorliegenden Materials sind jedoch mit denen der Typus-Serie identisch.

Untersuchtes Material: Rußland: 1 ♂, Kuznetzova leg., Galichya Gora, 15. 5. 1974 (AB); 1 ♀, Kuznetzova leg., Galichya Gora, 6. 5. 1974 (AB); 1 ♀, Kuznetzova leg., Galichya Gora, 6.—15. 5. 1974 (ZMHB).

Verbreitung: Bisher nur vom Typus-Fundort bekannt.

Beschreibung

Diagnose: Die ♀♀ sind durch die kürzere und auf den Abdominaltergiten weniger dichte Körperbehaarung, die ♂♂ durch die Form des Gonostylus (Abb. 16d) von den übrigen europäischen Arten der *alpina*-Gruppe zu trennen.

♂: Kopf (Abb. 39): Gesicht an Mittelhöcker und Mundrand wenig vorspringend, schwarz glänzend, unterhalb der Fühler und an den Seiten zart gelbgrau bestäubt. Augen lang blaßgelb behaart. Stirn mit deutlicher Mittelfurche, entlang der Augenränder schmal silbergrau bestäubt; Behaarung von Stirn, Scheiteldreieck und Occiput blaßgelb, gelegentlich vereinzelte

dunkle Haare an der Spitze des Scheiteldreiecks. Fühler (Abb. 18c) gelb bis dunkel-orange, 1. Glied dunkel. Genae etwa so breit wie der Durchmesser der t1, glänzend schwarz, blaßgelb behaart.

Thorax: Scutum und Scutellum glänzend schwarz, abstehend, mäßig dicht und mäßig lang gelbgrau behaart, lateral und vor dem Scutellum gelegentlich vereinzelte dunkle Haare beigemischt. Pleuren zart grau bestäubt mit langen, sehr blassen graugelben Haaren. — Beine: Apices der Femora relativ scharf abgesetzt gelb; Tibien mit undeutlichem dunklen Ring (oft kaum wahrnehmbar); p1-Tarsen dorsal, p3-Basitarsus dorsal und die beiden Endglieder aller Tarsen geschwärzt. — Flügel schwach gelblich mit Andeutung eines bräunlichen Mittelflecks (variabel); Adern der Flügelbasis gelblich. Halteren gelbbraun mit dunklerem Köpfchen.

Abdomen: Tergite glänzend schwarz, mäßig lang abstehend behaart (T1—3 rötlichgelb, T4—5 heller). S2—5 schwarz glänzend, S1 grau bestäubt; S2 durchgehend und lang abstehend hell behaart. — Hypopygium (Abb. 7, 14, 16d, 17d) ähnlich *alpina* und *montana*, aber dorsaler Lobus des Gonostylus länger und kräftiger.

Maße: Körper 11,0—12,0 mm; Flügel 8,5 mm.

♀: Farblich dem ♂ sehr ähnlich. — Kopf (Abb. 38): Gesicht dichter und ausgedehnter bestäubt. Fühler (Abb. 19c): 3. Glied größer und heller. Stirn (Abb. 37) und Scheitel abstehend blaßgelb behaart.

Thorax: Scutum fein punktiert, mit relativ kurzen (kürzer als der Durchmesser von f3), dichtstehenden rötlichen Haaren von annähernd gleicher Länge. Tibien ohne deutliche dunkle Zeichnung, wie auch die Tarsen heller als beim ♂. Die von f3 ventral und dorsal abstehenden Haare kürzer als der Durchmesser von f3 (Abb. 31).

Abdomen: T1—2 lateral mit längeren rötlichen Haaren (auf T2 mehr als doppelt so lang wie auf dem Scutum); T1—2 medial sowie T3—5 sehr locker und kurz abstehend blaßgelb behaart (auf T3 medial kürzer als der Durchmesser des p2-Basitarsus). Sternite wie beim ♂, aber kürzer behaart.

Maße: Körper 9,5—12 mm; Flügel 8,4 mm.

Präimaginalstadien: nicht beschrieben.

Cheilosia montana Egger, 1860

Cheilosia montana Egger, 1860; Verh. zool.-bot. Ges. Wien 10: 350; loc. typ.: „Austria Alpes".
Chilosia trisulcata Becker, 1894; N. Acta Acad. Leop. 62(3): 426; loc. typ.: Norditalien, Turin.
Chilosia braueri Becker, 1894; N. Acta Acad. Leop. 62(3): 435; loc. typ.: Zentralalpen, Ortler, Stilfser Joch. Syn. n.
Chilosia thalhammeri Szilády, 1938; Annls hist.-nat. hung., Pars Zoologica 31: 142; loc. typ.: Ost- und Nordkarpaten: Körösmezö und Tátraszéplak. Syn. n.

Typen: *Cheilosia montana* Egger: Lectotypus ♂, hiermit festgelegt. Etikettierung: „*montana* det. Egger.", „*montana* Egg. det. Becker.", „montana Egg.", in Coll. Schiner & Egger NHMW. Erhaltungszustand: Gut; das Genital wurde mazeriert und befindet sich in einem Glasröhrchen an der Nadel des Lectotypus. — Paralectotypus: 1 weiteres ♂ auf derselben Nadel wie der Lectotypus. In der Schiner-Eggerschen Sammlung stecken 3 von Egger determinierte Exemplare: Die beiden oben aufgeführten ♂♂ entsprechen der Originalbeschreibung und werden als Syntypen aufgefaßt. Das obere der zusammen genadelten Exemplare ist der Lectotypus. Das 3. Exemplar, ein ♀ von *montana*, trägt die gleichen Etiketten wie der Lectotypus. Es zeigt jedoch auf den Seiten des Scutums eine deutliche Beimischung schwarzer Haare und steht damit im Widerspruch zur Originalbeschreibung. Dieses Exemplar wird deshalb nicht als Syntypus betrachtet. Lectotypus und Paralectotypus wurden als solche etikettiert.

Chilosia trisulcata Becker: Holotypus ♀. Etikettierung: „*trisulcata* Beck.", „234/32 Turin, Italie, coll. Ferrero", „3863. *canicularis*", „234/12", „710", in Coll. Muséum d'Histoire naturelle, Genf (vgl. Claußen 1988).

Chilosia braueri Becker: Holotypus ♂. Etikettierung: „Brauer-Handl. Stilfserjoch 90", „*Braueri* det. Becker", „*Braueri* Beck. Typ.", in Coll. NHMW. Erhaltungszustand: Tarsen 2—5 an p2 links fehlen, sonst vollständig. — Das Exemplar entspricht der Originalbeschreibung. Es ist ein stark abgeflogenes Exemplar von *montana* mit fast völlig abgeriebener Gesichtsbestäubung. Das Hypopygium wurde mit dem des Lectotypus von *montana* direkt verglichen: Bei *braueri* ist die Kammlamelle des Surstylus geringfügig flacher als bei dem Vergleichstier, ansonsten stimmen die Genitalia beider Exemplare völlig überein. *C. braueri* Becker, 1894 wird daher als Synonym zu *C. montana* Egger, 1860 gestellt, Syn. n.

Chilosia thalhammeri Szilády: Syntypen (mehrere ♂♂) zerstört. Nach der Originalbeschreibung „mit *Ch. montana* verwandt, aber durch tiefschwarze Grundfarbe und ganz schwarze, struppige Behaarung verschieden . . ." (Szilády 1938: 142). Alle in der Originalbeschreibung zur Trennung von *montana* angeführten Merkmale liegen innerhalb der Variationsbreite von *montana*, so daß *C. thalhammeri* Szilády, 1938 als Synonym zu *C. montana* Egger, 1860 gestellt wird, Syn. n.

Weiteres Material: Österreich: 1 ♂, E. Torp leg., Groß-Glockner, Edelweißspitze, 2570 m, 27. 6. 1973 (ET); 1 ♂ 1 ♀, CC leg., West-Tirol, Paznauntal N Ischgl, Madleinsee, 2400 m, 13. 7. 1986 (CC); 1 ♂ 2 ♀♀, CC leg., West-Tirol, Bezirk Paznaun, S Galtür, oberes Jamtal, 1800—2200 m, 15. 7. 1986 (CC); 5 ♂ 1 ♀♀, CC leg., West-Tirol, Bezirk Paznaun, S Mathon, oberes Laraintal, 2200—2400 m, 18.—25. 7. 1986 (CC); 1 ♀, CC leg., West-Tirol, Bezirk Paznaun, SE Kappl, oberes Grübletal, 2000 m, 21. 7. 1986 (CC); 1 ♀, CC leg., Montafon, oberes Kromertal, Saarbrücker Hütte, 2500 m, 22. 7. 1986 (CC); 1 ♀, Mhs leg., Tirol, Naitener Lizum u. Mölztal, 2000 m, 24. 7. 1953 (ZFMK). Deutschland: 1 ♀, Doczkal leg., D Alpen Oberstdorf, Nebelhorn, Koblat, 1920—2220 m, 4. 7. 1994, 8528SW (DD); 1 ♂, Doczkal leg., D Alpen Oberstdorf, Fellhorn Umg. Schlappoltsee, 1719—2038 m, 5.7.1994 (DD). Schweiz: 1 ♂, M. Daccordi leg., Valais, dint. Col Bretolet, 1800—2000 m, 17. 7. 1989 (MD); 1 ♂, J. A. W. Lucas leg., Graubünden, Davos, Ischalp, 1931—2074 m, 23. 7. 1979 (CC); 1 ♂, W. Barkemeyer leg., Davos, Flüelapaß, 2380 m, 7. 8. 1979 (CC). Italien: 2 ♂♂ 2 ♀♀, CC leg., Südtirol, Vinschgau, Planeiltal, 2000—2400 m, 7. 7. 1988 (CC); 1 ♂ 1 ♀, D. Doczkal leg., gleicher Fundort, 2150—2400 m, 28. 6. 1992 (DD); 1 ♂ 1 ♀, J.-H. Stuke leg., Südtirol, Vinschgau, Langtaufertal, 1900—2100 m, 30. 6. 1992 (JS); 4 ♂♂ 6 ♀♀, CC leg., Südtirol, Vinschgau, Val di Mázia, 2100 m, 9. 7. 1988 (CC); 2 ♀♀, M. Daccordi leg., Gran San Bernardo AO, 2400 m, 18. 7. 1990 (MD/CC); 1 ♀, W. Barkemeyer leg., Aosta, Gr. S. Bernardo, 2300 m, 29. 7. 1979 (CC); 5 ♂♂ 5 ♀♀, M. Daccordi leg., Passo Stelvio SO, 1600—2000 m, 22. 7. 1988 (MD/CC); 6 ♂♂ 3 ♀♀, M. Daccordi leg., gleicher Fundort, 2600 m, 30. 7. 1991 (MD/CC); 2 ♀♀, M. Daccordi leg., Trentino, Rabbi Mge. Stablat, 1600 m, 27. 7. 1986 (MD/CC); 4 ♂♂, M. Daccordi leg., Trentino, Passo Gavia, 27. 7. 1990 (MD). Rumänien: 2 ♂♂, V. Brădescu leg., Südkarpaten, Mt. Făgăras, V. Simbetei, 1400 m, 8.—9. 7. 1988 (CC); 1 ♂ 1 ♀, V. Brădescu leg., Karpaten, Mt. Retezat, Taul Stirbu, 21. 7. 1982 (CC); 1 ♂, V. Brădescu leg., Karpaten, Mt. Retezat, Taul Negru, 31. 7. 1976 (VB); 1 ♂, V. Brădescu leg., Karpaten, Mt. Retezat, Gemenele, 4. 8. 1976 (VB). Spanien: 1 ♂, M. A. Marcos-Garcia leg., Kantabrisches Gebirge, Leon: Leitariegos, Laguna de Arbás, 1700 m, 13. 6. 1986 (AM) (vgl. Marcos-Garcia 1989, sub nom. *Cheilosia alpina*).

Verbreitung: In den Hochgebirgen Mitteleuropas; oberhalb der Waldgrenze: Kantabrisches Gebirge (Nordspanien); Alpen (Schweiz, Deutschland, Österreich, Italien); Tatra-Gebirge (Kempny 1956: Slovakei; Malski 1959: Polen); Karpaten (Rumänien).
[Nachweise aus Bulgarien (Bańkowska 1967) erscheinen fraglich: 1 ♀ „Bulgaria Sofija Vitoša 21. 5. 1959 leg. R. Bańkowska — Inst. Zool. PAN Warszawa 59/59 — *Cheilosia montana* Egg. det. R. Bańkowska" und 1 ♂ „Bulgaria Pirin 1500 m npm 1. 6. 1964 leg. R. Bańkowska — Inst. Zool. PAN Warszawa 97/64 — *Cheilosia montana* Egg. det. R. Bańkowska" in Coll. E. Torp, Jelling, Dänemark, wurden überprüft. Beide Exemplare gehören zu *Cheilosia melanura* Becker, 1894. — Nach Vujić (1996) beruhen auch die Angaben für die Vojvodina (Serbien) (Glumac 1972: 53) und für Macedonia (Glumac 1968: 865, sub nom. *trisulcata*) auf Fehlbestimmungen. — Barkalov (briefl. 1991) kennt keine Exemplare aus Sibirien und der Mongolei, so daß sich vermutlich auch die Angabe für Turkestan (Szilády 1938: 142) nicht auf *montana*, sondern auf eine der asiatischen Arten der *alpina*-Gruppe bezieht].

Beschreibung

Diagnose: Sehr ähnlich *alpina*; Körper tiefschwarz, glänzend und fein punktiert; meist durch das etwas stärker herabgezogene und im Verhältnis zur Kopfhöhe weniger weit vorspringende Gesicht (Abb. 42), die stärkere Ausdehnung der schwarzen Behaarung sowie die im Verhältnis zu dm schmalere cua1 (Abb. 20—21) zu unterscheiden (siehe aber unter „Variabilität"!).

♂: — mit den folgenden Unterschieden zu *alpina*: Kopf (Abb. 42, 43): Genae ausgedehnter, gelegentlich ganz schwarz behaart. Fühler (Abb. 18b) schwarz, 3. Glied bei frischen Tieren bräunlich aufgehellt. Lunula dunkelbraun bis schwarz, nur wenig mit der Stirn kontrastierend; Oberrand der Lunula in der Mitte meist deutlich V-förmig eingekerbt (meist durchlaufend bei *alpina*).

Thorax: Scutum lateral und vor dem Scutellum ausgedehnter schwarz behaart (oft überwiegend schwarz), auf der Vorderhälfte medial helle Haare beigemischt (variabel). Scutellum überwiegend schwarzhaarig. Behaarung der Pleuren oft überwiegend schwarz, insbesondere Katepisternum ventral fast stets mit kräftigen schwarzen Haaren. — Flügel (Abb. 20): meist ohne Mittelfleck, aber r-m und m-cu gebräunt; cua1 schmal, nicht breiter als basale Hälfte von dm. Flügeladern auch in der basalen Hälfte dunkel. — Beine schwarz, äußerste Spitzen der Femora sowie Basis (1/3) und Apices der Tibien gelblich bis düster-orange, oft t1 und t3 auch distal dunkel. Tarsen bis auf die beiden basalen Glieder von p2 zumindest dorsal geschwärzt. Behaarung der Beine schwarz und gelblich (sehr variabel): Die langen Haare auf der Hinterseite von f1 und f2 ganz schwarz oder von der Basis der Femora her mit hellen Haaren vermischt. Distale Hälfte von f3 anterodorsal meist mit lang abstehenden schwarzen Haaren (helle Haare bei einzelnen Stücken aus den Karpaten).

Abdomen: schwarz glänzend; Tergite lang abstehend blaß-orange behaart oder in unterschiedlicher Ausdehnung schwarzhaarig: oft Vorder- und Hinterecken von T2—4 mit schwarzen Haaren, seltener T4 auch am Hinterrand schwarzhaarig oder T2—4 fast vollständig schwarz behaart (1 ♂, Österreich, Groß-Glockner). Sternite ähnlich behaart wie bei *alpina*, aber die lang abstehenden Haare auf S2—4 oft schwarz. S8 (Prägenitalsegment) ganz oder überwiegend schwarz behaart. — Hypopygium (Abb. 5, 6, 12, 13, 16c, 17c) ohne konstante Unterschiede zu *alpina*; meist Kammlamelle des Surstylus geringfügig länger und flacher.

Maße: Körper 9,5—12,2 mm; Flügel 7,8—10,5 mm.

♀: Dem ♂ sehr ähnlich, aber insgesamt etwas kürzer und heller behaart. — Kopf: Seitenfurchen der Stirn ähnlich breit wie bei *alpina*. Stirn, Scheitel und Occiput meist teilweiseschwarzhaarig. Fühler (Abb. 19b) schwarz, 3. Glied gelegentlich bräunlich, nicht mehr als doppelt so hoch wie das 2. Fühlerglied. Dorsaler Rand der Lunula meist V-förmig eingeschnitten.

Thorax: Scutum und Scutellum lang abstehend rötlich-gelb behaart, lateral sowie vor und auf dem Scutellum meist mit eingesprengten schwarzen Haaren. Pleuren lang abstehend gelblich und schwarz behaart, zumindest dorsale Hälfte des Katepisternums immer auch mit schwarzen Haaren. — Flügel ohne deutlichen Mittelfleck, aber r-m und m-cu gebräunt; M1 spitzwinklig in R4+5 mündend (Abb. 24); cua1 schmaler oder gleich breit wie basale Hälfte der dm (Abb. 21). — Beine: Tibien und Tarsen oft etwas ausgedehnter hell. Distales 1/3 von f3 (Abb. 27) anterodorsal fast stets mit lang abstehenden schwarzen (sehr selten ganz hellen) Haaren, diese stärker nach außen geneigt als bei *alpina* (Abb. 28), in Seitenansicht daher weniger weit aufgerichtet. Hintercoxen anterolateral mit schwarzer, selten ganz heller Behaarung.

Abdomen: Breitoval, schwarz glänzend, fein punktiert. Tergite abstehend fahlgelb bis rötlich-gelb behaart. Behaarung der Sternite hell.

Maße: Körper 9,0—12,5 mm; Flügel 8,2—10,5 mm.

Variabilität: Gesichtsprofil in beiden Geschlechtern variabel, so daß dieses Merkmal nicht immer zur Abgrenzung von *alpina* herangezogen werden kann. Bei den ♂♂ können die Abdominaltergite 2—4 ganz hell bis fast ganz schwarz behaart sein. 1 ♂ (Italien: Südtirol, Vinschgau, Planeiltal, 2150—2400 m, 28. 6. 1992) trägt auf beiden Gesichtsseiten 4—5 lange, schwarze Borstenhaare. Die vorliegenden ♂♂ aus den Karpaten sind auf T2—4 intensiver rötlich behaart als Tiere aus den Alpen; schwarze Haare fehlen auf T2—4. Das 3. Fühlerglied

ist bräunlich aufgehellt, obwohl die Stücke stark abgeflogen und folglich ausgefärbt sind. — Das einzige bisher aus Spanien bekannte Exemplar (♂) trägt auf T2—4, den Pleuren, den Coxen der p3 und dorsal auf f3 keine schwarzen Haare. Es wurde von mir früher zu *alpina* gestellt (vgl. Marcos-Garcia 1989). Aufgrund des Flügelgeäders (cua1 schmal) wird diese Bewertung jetzt revidiert. Der Status der nordspanischen Population muß jedoch auf einer breiteren Materialgrundlage geklärt werden.

Präimaginalstadien: nicht beschrieben.

Cheilosia pictipennis Egger, 1860

Cheilosia pictipennis Egger, 1860; Verh. zool.-bot. Ges. Wien 10: 352; loc. typ.: Österreich, Alpen: „Schneeberg" (bei Wien).

Chilosia „innominata" (Becker in Bezzi & Stein, 1907); Kat. pal. Dipt., 3: 36 (als Varietät von *pictipennis*); loc. typ.: „Silesia".

Chilosia bureschi Delkeskamp, 1942; Mitt. dt. ent. Ges. 11: 11; loc. typ.: Bulgarien, Pirin-Gebirge, Potschiren-Dom bei Bansko. Syn. n.

Cheilosia zmilampis Violovitsh, 1975; Taksonomiya i ekologiya zhivotnykh Sibiri (Novye i maloizvestnye vidy fauny Sibiri, 9): 82 (*Cheilosia*); loc. typ.: Altai, Karasuk. Syn. n.

Typen: *Cheilosia pictipennis* Egger: Lectotypus ♂, hiermit festgelegt. Etikettierung: „Schneebg. [unleserlich: ‚Brauer' ?]", „*signatipeñis*", „*pictipennis* Typ. Egger", „*pictipeñis* det. Egger"; in Coll. Schiner & Egger NHMW. Erhaltungszustand: gut. — Der Lectotypus wurde als solcher etikettiert, er entspricht der Originalbeschreibung. Aus dem Naturhistorischen Museum Wien wurden 5 weitere, als fragliche Syntypen von *pictipennis* ausgewiesene Exemplare untersucht. Aufgrund der Daten wird hier keines dieser Exemplare als Syntypus betrachtet: 1 ♀ „Schiner 1869", „*chrysocoma* Egger", „*chrysocoma* Egg. det. Beck." ist *pictipennis*; 1 ♂ „Schiner 1869", „*pictipeñis* det. Schiner" ist *subpictipennis*; 1 ♀ „Gumpoldskrn., N. Ö. 28. 4. 12, Czerny" ist *subpictipennis*; 1 ♀ „Austria 5.18.56", „*pictipennis* Egg. det. Michl" ist *subpictipennis*; 1 ♀ „Mödling", „*asilica* Fall. Alte Sammlung" ist *subpictipennis*).

Chilosia „innominata" (Becker in Bezzi & Stein): In Coll. ZMHB wurde nur ein Exemplar gefunden, das als Varietät von *pictipennis* gekennzeichnet ist: „*Chilosia pictipennis* var m 2885", auf der Rückseite des Etikettes: „Landov 8/7 84". Da die Tergite 1—4 bei diesem Tier hell behaart sind, kann es sich nicht um die von Becker (1894: 409) beschriebene Varietät handeln. — Die Synonymie von „*innominata*" erscheint nach der Beschreibung jedoch nicht zweifelhaft.

Chilosia bureschi Delkeskamp: Holotypus ♀. Etikettiert: „Typus", „Bulgarien, Pirin-Gebirge 1200 m, Potschiven-Dom bei Bansko, leg. 1—10. 7. 38 Ziegenhagen", „*Chilosia bureschi* Delk. det. Delkeskamp 1941", „F 163", „*Cheilosia pictipennis* Egger det. Claußen 1987", in Coll. ZMHB. Erhaltungszustand: gut. — Ein Exemplar mit schwach ausgeprägten Flügelflecken; in allen weiteren Merkmalen mit der schwarzhaarigen Form von *pictipennis* identisch. *C. bureschi* Delkeskamp, 1942 wird daher als Synonym zu *C. pictipennis* Egger, 1860 gestellt. Syn. n.

Cheilosia zmilampis Violovitsh: Typen nicht untersucht. Das vorliegende Material aus Innerasien (Altai, Sajan) sowie die Abbildungen des Genitale in Violovitsh (1983: 192) lassen jedoch keinen Zweifel an der Synonymie zu. *C. zmilampis* Violovitsh, 1975 wird daher als Synonym zu *C. pictipennis* Egger, 1860 gestellt. Syn. n.

Weiteres Material: Österreich: 1 ♀, G. Strobl leg., bei Admont a. d. Ems, Ende April (Paratypus von *chrysocomoides*) (NMBA); 1 ♀, CC leg., Hohe Tauern, Virgental: Maurertal, 1600 m, 11. 7. 1991 (CC); 1 ♂, CC leg., West-Tirol, Paznauntal, ca. 2 km NE Mathon, 1400—1500 m, 14. 7. 1986 (CC). Deutschland: 1 ♂ 3 ♀♀, D. Doczkal leg., D Alpen, Oberstdorf Mädelegabel Vorderer Bockkar, 1880—2084 m, 3. 7. 1994 (DD); 1 ♂, D. Doczkal leg., D Alpen, Oberstdorf Nebelhorn Koblat, 1920—2220 m, 8528SW, 4. 7. 1994 (DD); 2 ♀♀, D. Doczkal leg., D Alpen, Oberstdorf Fellhorn Umg. Schlappoltsee, 1719—2038 m, 5. 7. 1994 (DD). Schweiz: 2 ♂♂ 1 ♀, J. A. W. Lucas leg., Uri, Andermatt, Gürschenalp, 2000—2200 m, 9. 7. 1985 (JL); 12 ♀♀, J. A. W. Lucas leg., Graubünden, Bergün, Latsch, 1588 m, 6. 7. 1979 (JL); 1 ♀, J. A. W. Lucas leg., Graubünden, Bergün, Val de Taors, 1400—1950 m, 7. 7. 1979

(JL); 1 ♂, J. A. W. Lucas leg., Graubünden, Davos, Sertigtal: Witi, 1600—1700 m, 16. 7. 1979 (JL); 1 ♂, J. A. W. Lucas leg., Graubünden, Davos, „ZO zijde Davoser See", 1500—1600 m, 22. 7. 1979 (JL); 2 ♂♂, J. A. W. Lucas leg., gleicher Fundort, 24. 7. 1979 (JL); 2 ♀♀, V. S. van der Goot leg. Graubünden, Clavadel, 1600—1700 m, 24. 7. 1974 (ZMAN); 2 ♂♂, P. Goeldlin leg., Gr. Val Chamuera, 25. 7. 1980 (MZLS); 1 ♂, Steck, Wallis, Useigne, 14. 5. 1934 (MZLU); 1 ♂, A. Maibach leg., Valais Lac Tanay, 16. 6. 1986 (MZLS); 1 ♂, A. Maibach leg., Valais Moosalp, Chalte Brunne, Moos 2042 m, 26. 6. 1986 (MZLS); 1 ♂, Valais, Cols de Cou et de Bretolet, 1900 m, 7. 7. 1968 (MZLS); 3 ♀♀, J. Aubert leg., Valais, Col de Bretolet, 7.—13. 6. 1976 (MZLS); 1 ♀, gleicher Sammler u. Fundort, 9. 7. 1972 (MZLS): 1 ♀, Bretolet, 14. 7. 1965 (MZLS); 1 ♀, Bretolet, 15. 7. 1964 (MZLS); 1 ♀, L. Rezbanyai leg., Rigi-Kulm SZ, 1600—1700 m, 14. 7. 1978, Tf (DD); 1 ♀, P. Goeldlin leg., Vaud Les Dévens, Bex, 18. 4. 1967 (MZLS); 1 ♀, P. Goeldlin leg., Vaud Les Pléiades, 14. 6. 1968 (MZLS). Italien: 1 ♂ 1 ♀, D. Doczkal leg., Südtirol, Trafoi Tartscher Wald, 1500—2100 m, 31. 5. 1993 (DD); 2 ♂♂, J.-H. Stuke leg., Vinschgau, Tartscher Wald, 31. 5. 1993 (JS); 4 ♀♀, D. Doczkal leg., Südtirol Schlinigerbach, 1750—1850 m, 1. 6. 1993 (DD/CC); 1 ♂ 1 ♀, D. Doczkal leg., Südtirol Schlinig, Niedermoor zw. St. Sebastian u. äuß. Alm, ca. 1850 m, 1. 6. 1993 (DD); 2 ♂♂ 3 ♀♀, J.-H. Stuke leg., Vinschgau, Schliniger Tal, 1. 6. 1993 (JS); 1 ♂, Südtirol, Planailtal, 2. 6. 1982 (JL); 1 ♂, E. Brockmann leg., NW Alpes, Valle de Aosta nördl. Nus (ONO Aosta) Valle di S Barthelemy bei Arlod, oberhalb Abfahrt Trois Villes, 1500 m, Fels-Matten, 1. 6. 1992 (PL); 1 ♀, Borsato-Brutti leg. Verona, Boscochiesanuova Rifugio S. Giorgio, 1800 m, 14. 6. 1987 (MD). Jugoslawien/Serbien: 1 ♂, A. Vujić leg., Kopaonik, 24. 5. 1987 (AV); 1 ♂, A. Vujić leg., 199 F. Durmitor Skrcko Zdrijelo, 8. 7. 1991 (CC). Bulgarien: 3 ♀♀, S. Tóth leg., Rodopehegység Batak, 24. 5. 1982 (ST). Rumänien: 1 ♂ 1 ♀, V. Brădescu leg., Mt. Retezat Toul Negrú, 31. 7. 1976 (VB). Russische Föderation: 1 ♂, A. Barkalov leg., Westlicher Sajan, Umgebung von Abasa, 25. 5. 1981 (CC); 1 ♀, A. Barkalov leg., Westlicher Sajan, 17. 6. 1981 (CC); 2 ♂♂, Exp. Mikkola, Hippa & Jalava leg., USSR, SW Altai 15 km S Katanda Bert-Kum, 2000—2500 m, 10.—14. 7. 1983 (MZHF).

Verbreitung: Europa, in der Nadelwaldzone der Hochgebirge, oft im Bereich alter Fichten- oder Lärchen-Fichtenwälder (Piceetum, Larici-Piceetum). — Alpen (Schweiz, Italien, Deutschland, Österreich); Balkangebirge: Kopaonik (Serbien), Berg Durmitor (Monte Negro); Pirin-Gebirge, Rodopen (Bulgarien); Südkarpaten (Rumänien); Kaukasus (Stackelberg & Richter 1968: 247; Barkalov briefl.). — Innerasien: Altai, Westlicher Sajan. — Weitere Literaturangaben sind wegen der bisherigen Verwechslung mit *subpictipennis*, die zusammen mit *pictipennis* auftreten kann, nicht zu verwenden.

Beschreibung

Diagnose: Sehr ähnlich *subpictipennis* und in einzelnen Exemplaren ähnlich *chrysocoma*. S2 medial in einem schmalen Längsstreifen nackt oder die Behaarung hier kürzer als lateral und niedergedrückt. ♂: Surstylus sehr lang und distal breit gerundet (Abb. 3). ♀: die kurze Behaarung auf der Ventralseite von f3 sehr gleichmäßig (Abb. 30); Hinterrand von T5 gerade abgestutzt, Gesichtsprofil (Abb. 32) zwischen Fühlerwurzel und Mittelhöcker etwas weniger stark nach unten verlaufend als bei *subpictipennis* (Abb. 33).

♂: Kopf: Gesicht schwarz glänzend, unter den Fühlern dicht gelblich-weiß bestäubt, Bestäubung lateral oft bis zum vorderen Mundrand herabreichend, so daß bei frischen Stücken nur der Mittelhöcker sowie ein Dreieck über dem seitlichen Mundrand unbestäubt bleiben. Genae etwa so breit wie der distale Abschnitt der t1, mäßig glänzend mit längeren gelblichen Haaren. Stirn schwarz, glänzend, zart grau bestäubt, an den Augenrändern mit etwas dichterer Bestäubung, Mittelfurche deutlich; Lunula gelblich-braun; Behaarung lang abstehend, gelblichweiß, seitlich der Fühlerwurzeln meist vereinzelte dunkle Haare. Scheitel lang abstehend hell behaart. Augen dicht und lang hell behaart, Occiput ganz hellhaarig. Fühler (Abb. 18f): 1. Glied meist dunkel, 2. und 3. Glied meist rötlich aufgehellt, 3. Glied etwas variabel: meist etwas länger als hoch, gelegentlich mit Andeutung einer Oberecke, dunkel-orange (selten schwarzbraun) mit fast kahler, schwarzer Arista.

Thorax: Scutum glänzend schwarzbraun, mäßig dicht und mäßig fein punktiert, dicht und lang abstehend blaß-orange bis fuchsrot behaart; zwischen den Flügelwurzeln meist eine oft unvollständige Binde aus kürzeren schwarzen Haaren und vor der Quernaht lateral gelegentlich vereinzelte längere dunkle Haare beigemischt. Behaarung der Pleuren lang, weißlichgelb. — Flügel: Fläche zart bräunlich, Adern im basalen Drittel gelblich, distal dunkler; zwischen Subcostalzelle und m-cu meist ein diffuser bräunlicher Fleck. Halteren gelbbraun mit dunklem Köpfchen. Squamulae blaß-orange, Saum geringfügig dunkler. — Beine: Coxae und Trochanteren schwarzbraun; alle Femora schwarz, apikal schmal gelb; Tibien dunkel-orange mit undeutlicher brauner Binde etwas unterhalb der Mitte (Breite der Binden auf t1 und t2 etwa $^1/_3$, auf t3 $^1/_2$ der Tibienlänge); Tarsen dorsal geschwärzt, aber die beiden basalen Glieder der p2 sowie Basitarsen der p1 und p3 distal meist gelb, oft auch weitere basale Tarsenglieder der p3 dorsal heller. Basitarsus der p3 (im Vergleich zu *subpictipennis*) schlank, etwa 3,5mal so lang wie an der Basis breit. Behaarung der Beine etwas variabel: an f1 vorn kurz, hell; hinten lang, an der Basis überwiegend hell, zur Spitze hin überwiegend schwarz; an f2 im distalen $^1/_3$ auch vorn kurz und schwarz; an f3 vorn lang hell und kurz schwarz, ventral in oft ganzer Länge mit schräg-abstehenden schwarzen Börstchen und einzelnen langen hellen oder hellen und schwarzen Haaren; Tibien und Tarsen in unterschiedlicher Ausdehnung kurz anliegend hell und schwarz.

Abdomen: Behaarung der T1-4 lang abstehend, farblich sehr variabel: T1 und der größte Teil von T2 meist blaß-orange (wie das Scutum); T3—4, oft auch der äußerste Hinterrand und die Hinterecken von T2 schwarz; aber auch T1—4 ganz hell oder Übergänge zwischen diesen Extremen. Oberfläche der Tergite auf den schwarz behaarten Abschnitten stark glänzend, tief schwarz, auf den hellen Partien mit bronzenem Schimmer, Segmente medial oft etwas matt. — S1 graugelb bestäubt, mäßig lang abstehend behaart; übrige Sternite glänzend schwarz, jedoch Vorder- und Hinterrand von S2 bestäubt; Behaarung von S2—4 an den Seiten lang abstehend hell, S2 medial in einem schmalen Streifen nackt oder kurz anliegend behaart, S3—4 medial kurz anliegend und überwiegend schwarz behaart. — Hypopygium (Abb. 3, 10, 16g, 17g,) durch die langen, distal breit gerundeten Surstyli gekennzeichnet.

Maße: Körper 12,0—13,8 mm: Flügel 10,8—12,0 mm.

♀: Bis auf die üblichen Geschlechtsunterschiede dem ♂ ähnlich. — Kopf (Abb. 32): Gesicht schwarz glänzend, wie beim ♂ in unterschiedlicher Ausdehnung bestäubt. Stirn mit den für die Gruppe charakteristischen breiten Seitenfurchen, deutlich punktiert und abstehend hell behaart. Fühler (Abb. 19f) einschließlich der beiden Grundglieder orange, mit zunehmendem Alter dunkler werdend, bis fast schwarz, das 3. Glied in der Form etwas variabel.

Thorax: Insgesamt etwas kürzer behaart als beim ♂; Scutum und Scutellum hell behaart, höchstens mit sehr vereinzelten schwarzen Haaren. — Flügel: M1 relativ steil in R4+5 mündend, Flügelfleck meist deutlich. Halteren gelblich. — Beine: meist etwas heller als beim ♂; die kurze Behaarung auf der Ventralseite von f3 sehr gleichmäßig und im Unterschied zu *subpictipennis* durchschnittlich kürzer als $^1/_3$ des Durchmessers von f3 (Abb. 30).

Abdomen: T1—5 mit Ausnahme der Seiten von T2 kürzer behaart als das Scutum; Haare abstehend, meist hell, aber Hinterränder von T2—5 gelegentlich auch schwarzhaarig. — Sternite etwas kürzer behaart, sonst wie beim ♂; S2 medial in einem schmalen Längsstreifen nackt oder mit kürzeren niedergedrückten Haaren; auch am Vorderrand von S3 fehlen medial kurze aufgerichtete Haare (relativ konstanter Unterschied zu *subpictipennis*).

Maße: Körper 12,0—14,0 mm; Flügel 10,4—11,8 mm.

Variabilität: Die helle Behaarung variiert in beiden Geschlechtern von blaßgelb bis fuchsrot. Die vorliegenden ♂♂ aus Jugoslawien, Rumänien und Bulgarien gehören sämtlich zu der Form mit überwiegend schwarz behaarten Abdominaltergiten. Die untersuchten Exemplare aus Innerasien sind auf T1—4 (bzw. 1—5) gänzlich hell behaart. In den Alpen treten beide Farbvarietäten nebeneinander auf.

Präimaginalstadien: nicht beschrieben.

Cheilosia subpictipennis sp. n.

Cheilosia pictipennis Barkalov in Violovitsh, 1983, nec Egger, 1860

Holotypus ♂. Etikettierung: „Schiner 1869", „*pictipeñis* det. Schiner", in Coll. Schiner & Egger (NHMW); loc. typ.: Vermutlich Österreich, Alpen. — Paratypen: Frankreich: 1 ♂, C.-F. Kassebeer leg., Pyr. [Pyrénees] Central Porte Puymoreus, 1900 m, 16. 6. 1991 (CK); 1 ♀, C.-F. Kassebeer leg., Mas. Central Cheires Hautes, 900 m, 2. 6. 1991 (CK); 1 ♀, C.-F. Kassebeer leg., Haute Provence Montagne de Lure, Jas de Bailles, 1200–1400 m, 22. 5. 1993 (CK); 4 ♀♀, C. J. Zwakhals leg., Savoi, Valmeinier, 1500 m, 13. 7. 1984 (JL); 1 ♀, M. C. D. Speight leg.; Malvau, c. 1800 ft., Vosges, N. E. France, Lambert grid 531.050, 12. 6. 1979 — "large clearing by stream, edge *Picea abies* plantation. Flying low among *picea* stumps" (MS); 1 ♀, M. C. D. Speight leg., Ballon d'Alsace, Vosges, N. E. France Lambert grid 531.050, ca. 3000 ft., 21. 6. 1979 — "*Picea abies* woods in glade on Flwrs. *Sorbus aucuparia*" (MS). Deutschland: 1 ♀, F. Malec leg., Hessen, Weißenborn, Werra-Meißner-Kreis, Graburg, Schäferburg, 15. 5. 1980 (FM); Baden-Württemberg, Schwarzwald: 1 ♀, R. Treiber leg., Bad Rippoldsau, 27. 5. 1987 (RT); 1 ♀, R. Treiber leg., Nordschwarzwald, Herrenwies, 7. 6. 1988 (RT); 2 ♀♀, D. Doczkal leg., Nordschwarzwald, Lautenbach-Sohlberg, Sumpfwiesen n Steighof, 640–670 m, 7414SE, 30. 4. 1994 (DD); 1 ♀, D. Doczkal leg., Nordschwarzwald, Ottenhöfer-Unterwasser, Kolbenloch, 550–650 m, TK7515SW, 30. 4. 1994 (DD); 1 ♀, R. Treiber leg., Freudenstadt, Kniebis, 11. 5. 1990 (RT); 2 ♂♂ 2 ♀♀, D. Doczkal leg. Nordschwarzwald, Kniebis, Zollstockhütte, 935 m, 7515NE, 16. 5. 1994 (DD/CC); 1 ♀, M. Hauser leg., Freudenstadt, Kniebis, 15. 6. 1988 (MH); 1 ♂, R. Treiber leg., gleicher Fundort, 30. 6. 1987 (RT); 1 ♀, R. Treiber leg., gleicher Fundort, 1000 m, 10. 9. [!] 1986 (RT); 1 ♂ 1 ♀, M. Hauser leg., Bernau-Dorf, Scheibenfelsen, 15. 6. 1988 (MH); 1 ♀, R. Treiber leg., Bernau, 1300 m, 16. 6. 1988 (RT); 1 ♂ 1 ♀, J.-H. Stuke leg., Feldberg, Toter Mann, 22. 4. 1991 (JS); 1 ♂ 1 ♀, J.-H. Stuke leg., gleicher Fundort, 14. 5. 1992 (JS/CC); 1 ♂ 1 ♀, C.-F. Kassebeer leg., gleicher Fundort, 1000 m, 22. 5. 1991 — an *Salix* (CK); 1 ♂, J.-H. Stuke leg., Feldberg 1 SE, Todtnauer-H., 22. 5. 1992 (JS); 1 ♀, Röseler leg., Feldberg, 30. 5. 1964 (PR); 10 ♀♀, U. Buchholz leg., Feldberg, Zastler Loch, 1280 m, 13.–16. 6. 1988 (UB); 1 ♀, J.-H. Stuke leg., Feldberg, Zastler Hütte, 16. 7. 1992 (JS); 1 ♂, Röseler leg., Wutach, W.-Grabenmel., 8. 5. 1960 (PR); 1 ♀, Röseler leg., Wutach, Waldäcker, 14. 5. 1960 (PR); 1 ♂, D. Doczkal leg., Vogelskopf, Grinden, 1020–1056 m, TK7415NW, 16. 5. 1994 (DD); 1 ♀, C.-F. Kassebeer leg., Zastler, Rappenfelsen, 22. 5. 1991 (CK); 1 ♂ 1 ♀, E. Krüger leg., Neustadt (Schwarzwald), 18.–25. 5. 1944 (CC); 1 ♂ 1 ♀, J.-H. Stuke leg., Gr. Kappler Tal, 24. 5. 1992 (JS/CC); 1 ♀, J.-H. Stuke leg., Waldau/St. Märg., 29. 5. 1993 (JS); 2 ♀♀, W. Maassen leg., Schluchsee, 3. 6. 1982 (JL); Baden-Württemberg: 1 ♂, D. Doczkal leg., Geisingen (Donau), NSG Hörnekopf UTM MU71, 750–780 m, 7. 5. 1990 (DD); 1 ♀, D. Doczkal leg., Mössingen, NSG Filsenberg UTM NU06, 750–805 m, 18. 5. 1990 (DD); 2 ♀♀, D. Doczkal leg., Kandel w Kandelhof, 1200–1230 m, 7914NW, 1. 6. 1994 (DD); 2 ♂♂, R. Treiber leg., Schwäbische Alb, Tieringen Lochenstein, 9. 6. 1980 (RT/CC), Thüringen, Thüringerwald: 1 ♂, R. Borcherding leg., Kleinschmalkalden, 3. 5. 1994 (RB); 1 ♀, 6. 5. 1994 (RB); 3 ♂♂ 1 ♀, 11. 5. 1994 (RB/CC); 1 ♀, 5. 6. 1993 (RB); 1 ♀, Hartmann leg., Vessertal, Breitenbach, 14. 5. 1988 (PL); 1 ♀, Creutzburg leg., Friedrichshöhe (Gelbschale), 27. 5. 1988 (PL); Bayern: 1 ♂, F. Stöcklein leg., Starnberger-Seengebiet, Maisingerschlucht, 22. 5. 43 [1943] (ZSMC); 1 ♀, gleicher Sammler und Fundort, 8. 5. 47 [1947] (JL). Schweiz: 1 ♂, P. Goeldlin leg., Vaud Agi Hes, 1. 6. 1968 (MZLS); 1 ♀, F. Geller-Grimm leg., GB Lantsch/Lenz, 900–1200 m, 31. 5. 1991 (FG); 1 ♀, J. A. W. Lucas leg., Graubünden, Bergün, 1367 m, 5. 7. 1979 (JL); 2 ♂♂ 1 ♀, J. A. W. Lucas leg., Graubünden, Latsch, 1588 m, 6. 7. 1979 (JL): 1 ♀, V. S. van der Goot leg., Graubünden, Bergün, 1400–1600 m, 7. 7. 1974 (ZMAN); 1 ♂, P. Goeldlin leg., VS Vers chez les Reuses, 19. 5. 1975 (MZLS); 1 ♀, M. Hauser leg., Wallis, Sion, 20. 5. 1991 (MH); 2 ♂♂ 2 ♀♀, P. Goeldlin leg., Valais, Lac Champex, 5. 6. 1968 (MZLS/JL); 1 ♂, P. Goeldlin leg., Valais, Van den Haut, 22. 6. 1968 (MZLS); 1 ♂, J. Aubert leg., Col de Bretolet, 6. 7. 1972 (MZLS); 1 ♀, M. Hauser leg., Niedergampe, 15. 5. 1991 (MH); 2 ♂♂, M. Hauser leg., Klausen, 3. 6. 1987 (MH). Italien, Alpen: 1 ♂, L. Verlinden leg., Val Venosta, Malles, Mazia 1800 m, 28. 5. 1982 (ZMAN); 3 ♂♂ 5 ♀, D. Doczkal leg., Vinschgau, Planeiltal, 1750–1850 m, 30. 5. 1993 (DD/CC); 13 ♂♂ 16 ♀♀, J.-H. Stuke leg., Fundort und Datum wie vorher (JS/CC); 2 ♀♀,

D. Doczkal leg., Südtirol, Trafoi, Köpfel, 2200—2400 m, subalp. Weide, 31. 5. 1993 (DD); 1 ♀, D. Doczkal leg., Südtirol, Trafoi, Tartscher Wald, 1500—2100 m, 31. 5. 1993 (DD); 1 ♂, J.-H. Stuke leg., Fundort und Datum wie vorher (JS); 1 ♀, D. Doczkal leg., Südtirol, Schlinig, Niedermoor zw. St. Sebastian u. äuß. Alm, ca. 1850 m, 1. 6. 1993 (DD); 1 ♀, D. Doczkal leg., Südtirol, Schlinigerbach, 1750—1850 m, 1. 6. 1993 (DD); 1 ♀, J.-H. Stuke leg., Vinschgau, Schliniger Tal, 1. 6. 1993 (JS); 1 ♀, L. Verlinden leg., Val Venosta, Malles, Planol, 1700 m, 2. 6. 1982 (ZMAN); 1 ♀, J.-H. Stuke leg., Vinschgau, Planeiltal, 1800—2000 m, 27. 6. 1992 (JS); 1 ♀, Miksch leg., Gardasee, Molina di Ledro, Val di Pur, 600—1200 m, 28. 5. 1992 (US); 1 ♂, Borsato-Brutti leg., Verona, Boscochiesanuova, Rifugio S. Giorgio, 1800 m, 14. 6. 1987 (MD); 1 ♀, Borsato-Brutti leg., gleicher Fundort, 1500 m, 20. 6. 1987 (MD). Österreich: 1 ♀, „Austria 18. 5. 56", „*pictipennis* Egg. det. Michl" (NHMW); 1 ♀, Czerny, Gumpoldskrn, N. Ö., 28. 4. 12 [vermutl. Gumpoldskirchen, Nieder-Österreich, 1912] (NHMW); 1 ♀, „Mödling", „*asilica* Fall. Alte Sammlung" (NHMW); 1 ♀, M. Hauser leg., Neusiedler See, Winden a. S., Bärenhöhle (Leithargebirge), 30. 4. 1993 (MH). Ungarn: 1 ♂, S. Tóth leg., Plattensee, Bakonywald, Keszthelyi-hg. Petó-hegy, 22. 4. 1977 (ST). Slowenien: 1 ♀, A, Vujić leg., Vrsic-Kranj. Gora, 1200 m, 23. 5. 1989 (AV). Jugoslawien/Makedonija: 2 ♀♀, Konjsko-Kuzuv, 995 m, 13. 6. 1975 (AV); Griechenland: 1 ♀, F. Borchmann leg., Olymp-Prioni, 1000 m, 3.—13. 6. 1975 (ZFMK).

Verbreitung: Nadelwaldzone: Zentraleuropäischer Mittelgebirgsraum (Zentralmassiv, Vogesen, Nordhessische Mittelgebirge, Schwäbische Alb, Thüringerwald), Schwarzwald, Pyrenäen, Alpen und Leithargebirge, Bakonywald, Balkangebirge (Makedonija, Olympos-Gebirge). — Westsibirien (Barkalov in Violovitsh, 1983: 80, sub nom. „*pictipennis*").

Beschreibung

Diagnose: Sehr ähnlich *pictipennis*, mit folgenden Unterschieden: Gesichtsprofil (Abb. 33) zwischen Fühlerbasis und Mittelhöcker etwas schräger nach unten verlaufend, S2 median lang abstehend behaart. ♂: Surstylus (Abb. 8) kurz; dorsaler und ventraler Lobus des Gonostylus (Abb. 16e) gleich lang. ♀: Die kurze Behaarung auf der Ventralseite von f3 (Abb. 29) länger und ungleichmäßiger als bei *pictipennis* (Abb. 30).

♂: Kopf: Gesicht zart graugelb bestäubt, Mittelhöcker und Seiten oberhalb des Mundrandes schwarz glänzend (Bestäubung bei älteren Tieren oft bis auf einen Streifen unterhalb der Fühlerwurzeln abgerieben). Gesichtsprofil zwischen Fühlerbasis und Mittelhöcker etwas schräger nach unten verlaufend als bei *pictipennis*, der Mittelhöcker dadurch etwas tiefer liegend (vgl. Abb. 32 und 33). Genae etwa so breit wie t1 distal, lang hell, unten aber meist auch schwarz behaart. Stirn schwarz, mäßig fein punktiert mit deutlicher Mittelfurche, an den Augenrändern schmal graugelb bestäubt, lang abstehend hell bis überwiegend schwarz behaart. Lunula meist wie die Stirn gefärbt, selten heller. Scheiteldreieck und die seitlich anschließenden Orbiten lang abstehend hell oder hell und schwarz behaart. Augen vollständig und lang behaart, Augenhaare farblich sehr variabel, von weißlich bis schwarzbraun. Fühler (Abb. 18d): Grundglieder meist geschwärzt, 3. Glied in der Form etwas variabel, dunkelorange (selten heller), Arista gleichmäßig verjüngt, schwarz.

Thorax: Scutum glänzend schwarzbraun, dicht und mäßig fein punktiert, vor dem Scutellum kaum merklich grau bestäubt; Behaarung lang abstehend, überwiegend blaßgelb bis rötlichgelb, zwischen den Flügelwurzeln oft eine Binde aus kürzeren und längeren schwarzen Haaren, die an den Seiten craniad in die helle Behaarung hineinziehen können; gelegentlich auch das Scutellum medial mit kürzeren schwarzen Haaren. Postalarcalli selten mit vereinzelten längeren schwarzen Haaren. Pleuren schwach grau bestäubt, lang abstehend, überwiegend hell behaart, Anepisternum und Anepimeron selten mit vereinzelten schwarzen Haaren. Flügel bei ausgefärbten Tieren schwach bräunlich-grau getönt, zwischen Subcostalzelle und m-cu ein diffuser bräunlicher Fleck (bei frischen Tieren undeutlich); Adern der basalen Flügelhälfte gelblich, distal geschwärzt. Halteren blaßbraun, Köpfchen dunkel. Squamulae weißlich mit etwas dunklerem Saum. — Beine: Femora schwarz, apikal schmal gelb; Tibien gelblich, distale $^3/_5$ undeutlich gebräunt; Tarsen überwiegend gelblich, aber die beiden Tarsenendglieder aller Beine oft dunkel sowie der p1- und p3-Basitarsus dorsal geschwärzt

(variabel); Behaarung der Beine sehr variabel: an f1 vorn kurz hell, hinten lang hell (basal, in sehr unterschiedlicher Ausdehnung) und schwarz (distal); an f2 ähnlich wie an f1, vorn jedoch etwas länger und in der distalen Hälfte auch schwarz; an f3 vorn in unterschiedlicher Ausdehnung lang hell (basal) und schwarz (distal), ventral meist in ganzer Länge mit schräg abstehenden, kurzen schwarzen Borsten und längeren hellen und schwarzen Haaren; Tibien und Tarsen kurz anliegend hell und schwarz behaart (sehr variabel).

Abdomen: Tergite schwarzbraun, teilweise mit bräunlich-violetten Reflexen, T1 und Vorderecken von T2 sehr schwach grau bestäubt; T2, gelegentlich auch T3, medial matt, die übrigen Partien der T2—4 einschließlich Hinterrand von T2 stark glänzend. Behaarung von T1—4 lang abstehend, dicht, farblich sehr variabel: hell (weißlich bis orange) und schwarz, die hellsten Exemplare sind vollständig hell behaart, die dunkelsten bis auf T1, die Vorderhälfte von T2 und die Vorderecken von T3—4 schwarzhaarig. — S1 und ein schmaler Vorderrand von S2, gelegentlich auch die Hinterränder von S2—4 graugelb bestäubt, die übrigen Partien dieser Sternite schwarz glänzend. Behaarung der Sternite: S1—2 (auch medial) lang abstehend hell, S3—4 seitlich lang abstehend hell oder hell und schwarz, medial überwiegend kurz und anliegend, zumindest teilweise schwarz behaart, oft auch vor dem Hinterrand von S2 medial ein Feld kürzerer schwarzer Haare zwischen den langen hellen. — Hypopygium (Abb. 8, 15, 16e, 17e): Surstylus kurz, dorsaler und ventraler Lobus des Gonostylus gleich lang.

Maße: Körper 9,9—13,5 mm; Flügel 9,3—12,0 mm.

♀: dem ♂ bis auf die üblichen Geschlechtsunterschiede sehr ähnlich, aber Behaarung etwas kürzer und weniger schwarz, Beine heller. - Kopf (Abb. 33): Genae oft auch im unteren Abschnitt ohne schwarze Haare; Stirn, Scheitel und Orbiten des Hinterkopfes abstehend hell behaart, die dicht und kräftig punktierten Seitenfurchen der Stirn 2/3 der Stirnbreite einnehmend; Augen etwas heller und kürzer behaart als beim ♂. Fühler (Abb. 19d): oft auch die beiden Grundglieder rötlich, 3. Glied groß, etwas „fleischig", in Form, Größe und Farbe variabel (hell- bis dunkel-orange, gelegentlich schwärzlich), Arista zart, schwarz, sehr kurz pubeszent.

Thorax: etwas kürzer behaart als beim ♂, blaßgelb bis fuchsrot, für gewöhnlich ohne Beimischung schwarzer Haare (nur eines der untersuchten ♀♀ mit deutlicher schwarzer Binde zwischen den Flügelwurzeln). — Flügel (Abb. 25): der braune Mittelfleck meist deutlicher und in der vorderen Flügelhälfte gelegentlich bis zur Flügelspitze reichend; M1 sehr steil in R4+5 mündend. Köpfchen der Halteren hell. — Beine: Tibien und Tarsen meist etwas heller als beim ♂ und weniger schwarz behaart; die kurze Behaarung auf der Ventralseite von f3 (Abb. 29) etwas länger als 1/3 des Durchmessers von f3 und ungleichmäßiger als bei *pictipennis.*

Abdomen: oft nur T1 mehr oder weniger deutlich bestäubt; Behaarung der T1—5 aufrecht, in der Länge variabel, deutlich kürzer als beim ♂, hell (blaßgelb bis hellorange) ohne Beimischung schwarzer Haare. — Sternite ähnlich bestäubt und behaart wie beim ♂, aber insgesamt etwas kürzer und heller, nur selten sind einzelne der kurz anliegenden Härchen medial auf S3—5 schwarz; S2 auch medial mit lang abstehenden Haaren und S3 im basalen 1/3 mit einem durchlaufenden Saum aufgerichteter, kurzer Härchen (bei *pictipennis* zumindest medial niedergedrückt).

Maße: Körper 10,5—13,5 mm; Flügel 9,5—10,3 mm.

Variabilität: Nach dem vorliegenden Material variiert die Art geographisch kaum.

Präimaginalstadien: D. Doczkal stellte großzügig die folgenden Beobachtungen zur Eiablage von *C. subpictipennis* im Nord-Schwarzwald (Baden-Württemberg) zur Verfügung: „1) Unterwasser bei Oberkirch, Kolbenloch, 570 m, frische Magerwiese, 30. 4. 1994, 2 ♀♀ mit Eiablageverhalten an *Meum athamanticum* Jacq. (Apiaceae). 2) Lautenbach-Sohlberg bei Oberkirch, 650 m, frische Magerwiese, 30. 4. 1994, 4 ♀♀ mit Eiablageverhalten an *Meum athamanticum.* 3) Gleicher Fundort, 8. 5. 1995, mehrere ♀♀ mit Eiablageverhalten, davon 1 ♀ bei der Ablage von 5 Eiern. Die Eier wurden unter die Blattscheide der Stengelbasis, wenige cm über dem Erdboden abgelegt, dabei waren die Eier nicht an die Wirtspflanze ange-

klebt, wie bei anderen *Cheilosia*-Arten, sondern nur sehr lose angeheftet. *Meum* war bisher als Wirtspflanze für *Cheilosia*-Larven nicht bekannt. Da außerhalb des Schwarzwaldes *Meum athamanticum* nicht an allen Fundorten von *C. subpictipennis* vorkommt, müssen weitere Pflanzenarten zum Wirtsspektrum von *C. subpictipennis* gehören.

Im Nord-Schwarzwald wurde *C. subpictipennis* ausnahmslos an den wenigen Standorten von *Meum athamanticum* festgestellt. Wegen des starken Bestandsrückganges von *Meum athamanticum* in diesem Gebiet muß *C. subpictipennis* zumindest hier als stark gefährdete Art betrachtet werden."

Danksagung

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Zusammenfassung

Die europäischen Arten der *Cheilosia alpina*-Gruppe (Barkalov, 1983a) werden revidiert. Die folgenden Arten werden festgestellt und beschrieben: *Cheilosia alpina* (Zetterstedt, 1838), *Cheilosia chrysocoma* (Meigen, 1822), *Cheilosia kuznetzovae* Skufjin, 1977, *Cheilosia montana* Egger, 1860, *Cheilosia pictipennis* Egger, 1860 und *Cheilosia subpictipennis* sp. n. Vier Arten werden in die Synonymie versetzt: *Cheilosia montana* Egger, 1860 = *Cheilosia braueri* (Becker, 1894), syn. n. = *Cheilosia thalhammeri* (Szilády, 1938), syn. n.; *Cheilosia pictipennis* Egger, 1860 = *Cheilosia bureschi* (Delkeskamp, 1942), syn. n., = *Cheilosia zmilampis* Violovitsh, 1975, syn. n. — Lectotypen werden für die folgenden Arten festgelegt: *Cheilosia alpina* (Zetterstedt, 1838), *Cheilosia phantoma* (Zetterstedt, 1838), *Cheilosia chrysocomoides* (Strobl, 1910), *Cheilosia montana* Egger, 1860 und *Cheilosia pictipennis* Egger, 1860. Die Arbeit enthält neue Nachweise, Verbreitungsangaben, Angaben zu Präimaginalstadien und einen Bestimmungsschlüssel für die behandelten Arten.

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Tersilochus curvator Horstmann und *Tersilochus* sp. n. (Ichneumonidae, Tersilochinae), neue Parasitoiden der an Birken minierenden Trugmotten (Lepidoptera, Eriocraniidae)

Thorsten Jordan

Abstract. *Tersilochus curvator* Horstmann and *Tersilochus* sp. n. (Ichneumonidae, Tersilochinae), new parasitoids of birch leaf mining *Eriocrania* species (Lepidoptera, Eriocraniidae). — *Tersilochus* species (Ichneumonidae, Tersilochinae) are known to be koinobiont endoparasites of concealed living beetle larvae (Coleoptera, mainly Curculionidae and Nitidulidae). A new rearing record from birch leaf mining Eriocraniidae, a primitive group of Lepidoptera, is presented. *Tersilochus curvator* was reared from *Eriocrania cicatricella*, and a new species, *Tersilochus* sp. n., from *Eriocrania unimaculella*. The parasitoids attack their host larvae in spring and develop inside the host cocoons in the soil. Adults remain in the cocoons from autumn to the following spring. *Tersilochus curvator* attacks young larvae of *E. cicatricella* while *Tersilochus* sp. n. attacks older larvae of *E. unimaculella* by attaching eggs with an anchor-like mechanism on the inner side of the hosts skin. Attacked larvae were recorded throughout Central Europe, from northern and southern Germany, the Alsace, the Swiss Rhone Valley and from northern Austria.

Key words: Tersilochinae, leaf miner parasitoids, Eriocraniidae, *Tersilochus*-eggs, new parasitoid-host relationship.

Einleitung

Die meisten Vertreter der artenarmen Unterfamilie der Tersilochinae (Ichneumonidae) entwickeln sich als solitäre Endoparasiten vorwiegend an Rüsselkäfern (Col., Curculionidae) und Glanzkäfern (Col., Nitidulidae) (Gauld & Bolton 1988). Von den 33 bekannten Arten aus der Gattung *Tersilochus* Holmgren, 1858, wurden allerdings erst 7 Arten einem Wirt zugeordnet, von denen sich 5 Arten an Rüsselkäferlarven und jeweils eine an einer Glanzkäfer- und einer Blattkäferart (Col. Chrysomelidae) entwickeln (Horstmann 1971, 1981; Klingenberg & Ulber 1994). Im Rahmen einer Studie über Birkenminierer schlüpften *Tersilochus*-Imagines aus Kokons von Kleinschmetterlingen der Gattung *Eriocrania* Zeller (Lepidoptera, Eriocraniidae). Dieser ungewöhnliche Zuchtbefund war Ausgangspunkt einer genaueren Analyse des Parasitoidenkomplexes der mit Birken assoziierten Trugmotten, die 1987 in Schleswig-Holstein begonnen und von 1990—1993 auf verschiedene Regionen Mitteleuropas ausgeweitet wurde. Im Verlauf der Arbeit wurden *Tersilochus curvator* Horstmann, 1981 (= *T. saltator* F., 1781), aus *E. cicatricella* sowie eine bislang noch unbeschriebene Art, *Tersilochus* sp. n. (Horstmann, pers. Mitt.), aus *E. unimaculella* gezüchtet. An den anderen gleichzeitig an Birken minierenden *Eriocrania*-Arten, *E. sangii* und *E. semipurpurella*, wurden bisher keine *Tersilochus*-Eier gefunden, auch schlüpften keine *Tersilochus*-Imagines aus den entsprechenden Zuchten. Da die Biologie und Wirtsbindung der beiden *Tersilochus*-Arten bisher unbekannt waren (Horstmann 1981), schien es lohnend, Untersuchungen zur Wirts- und Stadienspezifität der Para-

sitoiden sowie zu ihrer Entwicklungsbiologie durchzuführen. Um den Einfluß der Parasitoiden auf die Populationsentwicklung ihrer jeweiligen Wirtsarten abzuschätzen, wurde der Parasitierungserfolg in verschiedenen Regionen Mitteleuropas erfaßt und für ausgewählte Standorte dargestellt.

Material und Methoden

Trugmotten (Eriocraniidae) stellen eine der ursprünglichsten Familien der Lepidoptera dar (Common 1975), deren paläarktische Arten alle in der Gattung *Eriocrania* Zeller, 1851, zusammengefaßt werden (Birket-Smith & Kristensen 1974). Von den 9 europäischen *Eriocrania*-Arten (Burmann 1958; Heath 1976) entwickeln sich 6 Arten im Frühjahr und Sommer an Birken (*Betula* spp.). *Eriocrania cicatricella* (Zetterstedt, 1839) (= *E. haworthi* Bradley, 1966; Karsholt et al. 1994), *E. sangii* (Wood, 1891), *E. semipurpurella* (Stephens, 1835), und *E. unimaculella* (Zetterstedt, 1840) minieren im Frühjahr und sind in Mittel- und Nordeuropa weit verbreitet (Davis 1978; Heath 1976; Koponen 1974). Die Weibchen legen ihre Eier in die aufbrechenden Knospen der Wirtspflanzen. Die Larven (L_1-L_4) fressen etwa 4—5 Wochen in den Minen, bevor sie Mitte bis Ende Mai aus den Minen abwandern und in den oberen Bodenschichten einen Kokon spinnen, in welchem sie, zunächst als Larve, ab August im Puppenstadium, bis zum nächsten Frühjahr ruhen (Hering 1957; Davis 1978).

Trugmottenarten wurden in verschiedenen Regionen Schleswig-Holsteins (n = 11 Standorte), in Hessen (2), Bayern (3), Baden-Württemberg (3), im französischen Elsaß (3), Schweizer Wallis und im Waldviertel (5) in Nordösterreich untersucht. Blattminen mit reifen Larven wurden Ende April bis Mitte Mai im Freiland gesammelt, in höheren Lagen bis Anfang Juni. Für Zuchten wurden abgewanderte Wirtslarven nach Arten getrennt auf sterilisiertes Sand/Blumenerdegemisch gelegt und die Zuchtgefäße (1,3 l-Plastikdosen) frostfrei in einer Erdkammer überwintert. Parasitierungsanalysen wurden an minierenden Wirten oder an abwandernden Altlarven durchgeführt. Zur Untersuchung der Parasitoidenentwicklung wurden reife Larven in feingesiebte Zuchterde überführt und ihre Kokons später isoliert. Die *Eriocrania*-Larven wurden nach Hering (1957) und die Imagines nach Heath (1976) bestimmt. Die Determination der *Tersilochus*-Imagines übernahm freundlicherweise K. Horstmann, Würzburg.

Ergebnisse

Imagines von *Tersilochus curvator* sind aus Nord- und Mittelschweden, Südfinnland, Südengland und Norddeutschland bekannt (Horstmann 1981). Die während dieser Untersuchung gezüchteten Imagines wurden ausschließlich aus *E. cicatricella*-Larven erhalten und stammen aus Walliser Larvenproben, dem Elsaß und in wenigen Exemplaren aus Norddeutschland. In den übrigen Regionen fehlte *T. curvator* im Parasitoidenkomplex von *E. cicatricella*, wie an Hand von Zuchten und Untersuchungen an minierenden Larven festgestellt wurde. Die Parasitierungsraten von jüngeren und erwachsenen Larvenstadien waren im Wallis ähnlich (Parasitierungsrate L_3 = 3,4 %, L_4 = 3,7 %, $\chi^2 = 0{,}13$ korrigiert nach Yates: nicht signifikant unterschiedlich, n = 320), wobei diese jeweils nur mit einem Parasitoidenei belegt waren. Lediglich in Junglarven (L_1 und L_2) wurden gelegentlich 2, 3 oder 4 *T. curvator*-Eier pro Larve vorgefunden (Wallis 1993, in 9 % der Wirtslarven, n = 55). Die Eier (Abb. 1a) sind gurkenförmig und werden frei im Wirt abgelegt.

Die Parasitoiden schlüpfen noch in den minierenden Wirtslarven aus ihren Eiern (etwa Ende April bis Mitte Mai). In den Wirtskokons wurden bis Anfang Juli Parasitoiden-Junglarven vorgefunden (L_1-L_2; n = 86 Parasitoide untersucht), die sich auf Grund der charakteristischen Larvengestalt (Abb. 1b) eindeutig *T. curvator* zuordnen lassen. Die weitere Entwicklung der Parasitoidenlarven (L_3-L_5) erfolgte

bis Anfang August (n = 81). Die Altlarven (Kopfkapsel siehe Abb. 1c) spinnen ab etwa Mitte August einen eigenen Kokon innerhalb des Wirtskokons, in dem sie sich verpuppen. Ab Ende August waren die ersten, ab Mitte September etwa die Hälfte der Imagines (48 %, n = 62) in den Kokons geschlüpft, in denen sie bis zum nächsten Frühjahr verblieben. Imagines aus Walliser Proben verließen die Kokons bei angenäherten Außentemperaturen (8—15 °C) zwischen Mitte und Ende März. Der Schlupfverlauf war gleichmäßig (50 % Schlupferfolg der Männchen und Weibchen jeweils am 25. 3. 1993), das Geschlechterverhältnis ausgeglichen (205 Männchen und 203 Weibchen geschlüpft). Einige Individuen verblieben längere Zeit in Diapause und schlüpften erst ein Jahr später (n = 3, Schlupf 1994).

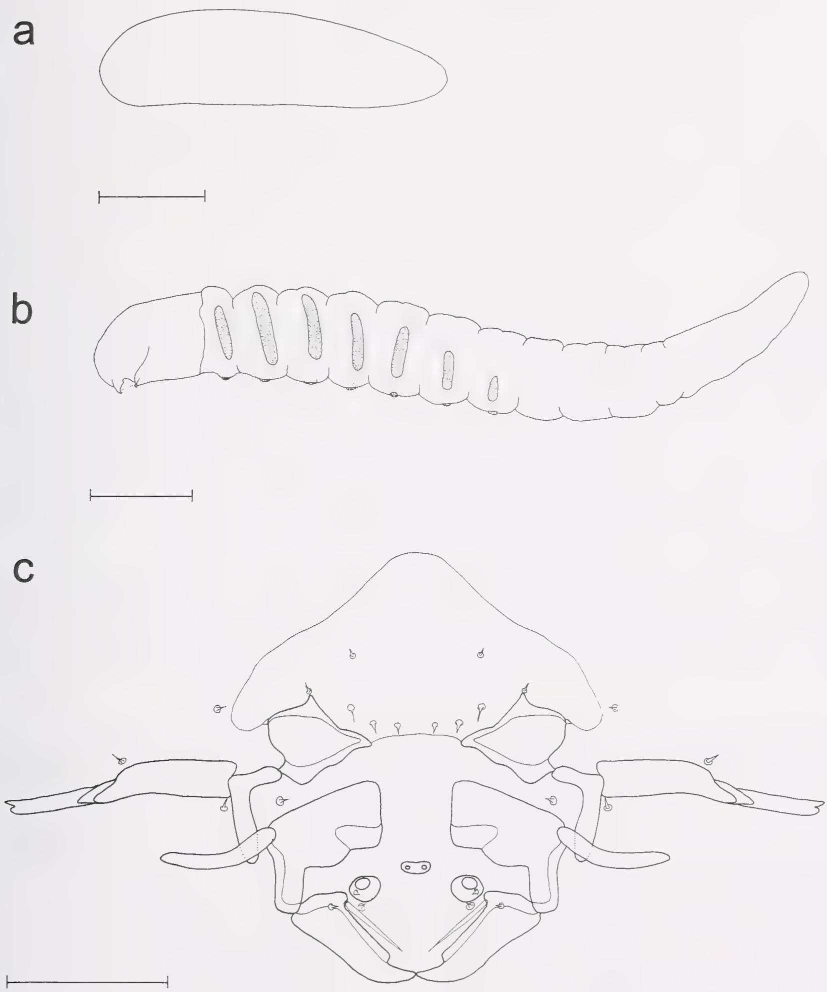

Abb. 1: Jugendstadien von *T. curvator*; Wirt: *E. cicatricella*. a) Eiform, b) Junglarve (L_1), c) Kopfsklerite der Altlarve. Maßstab jeweils 0,1 mm.

Die Parasitierungsraten waren im allgemeinen gering, wie im Elsaß (4,4 % ± 1,9 S.E.) und im Wallis, wo der Parasitierungserfolg von 1990 mit 2,8 % ± 0,8 S.E. auf 1,2 % ± 0,5 S.E. abnahm (1991) und dann 1992 auf 3,8 % ± 1,1 S.E. anstieg. 1993 waren im Wallis 9,9 % ± 1,1 S.E. der *E. cicatricella*-Larven durch *T. curvator* parasitiert.

Eine bisher unbeschriebene Art, *Tersilochus* sp. n. (det. Horstmann), wurde ausschließlich aus *E. unimaculella*-Larven gezüchtet. Eier dieses Endoparasitoiden wurden in allen 5 untersuchten Regionen, an 15 von 22 Sammelplätzen mit Befall von *E. unimaculella*, nachgewiesen, wobei die Parasitierungsraten zwischen 0,6 % und 35,1 % schwankten. In den 5 größten Wirtspopulationen (Probengröße n = 210—820 *E. unimaculella*-Larven, gesamt n = 2210) waren im Mittel 18,9 % ± 7,8 S.E. der Wirtslarven (L_4) parasitiert. Befallene Wirtslarven wurden ebenfalls bei niedrigen Dichten (Anzahl gefundener *E. unimaculella* Minen < 80) nachgewiesen, wobei die Parasitoiden 3 %—35 % der Wirtslarven mit Eiern belegten (Tab. 1). An einem Standort in der Nähe von Kiel (Norddeutschland) war *Tersilochus* sp. n. ein dominanter Parasitoid von *E. unimaculella*. Die Parasitierungsraten betrugen 1989 25,5 % ± 5,1 S.E., 1990 24,5 % ± 4,3 S.E. und 1991 19,2 % ± 4,5 S.E. Die Minendichten von *E. unimaculella* sanken in diesem Zeitraum von 7,9 % befallener Birkenblätter (1989, n = 3110 Blätter untersucht) auf 4,4 % (1990; n = 1750), bzw. 3,7 % ab (1991, n = 1440).

Tersilochus sp. n.-Weibchen legen ihre Eier wenige Tage vor dem Abwandern der Wirtslarven ab, wie Untersuchungen in Kiel ergaben. So waren am 15. Mai in Blattproben noch keine *E. unimaculella*-Larven parasitiert (n = 107, 60 % L_4), jedoch die 3 Tage später aufgesammelten Wirtslarven zu 37 % durch *Tersilochus* sp. n. befallen, wobei Dritt- und Viertlarven gleichmäßig belegt wurden ($\chi^2 = 0{,}02$, korrigiert nach Yates; n = 161). Superparasitierungen mit 2 oder 3 *Tersilochus* sp. n.-Eiern pro Wirtslarve traten in der Regel erst bei Befallsraten von über 10 % auf (Tab. 1). Das Ausmaß der Mehrfachbelegungen stieg in den untersuchten Wirtspopulationen signifikant mit der Zunahme der Parasitierungsraten an (Spearman Rank Korrelationskoeffizient $r_s = 0{,}983$; Test zweiseitig, $\alpha = 0{,}05$, n = 17).

Genauere Untersuchungen der Eiablage an *E. unimaculella* ergaben einen ungewöhnlichen Befund: *Tersilochus* sp. n. befestigt die Eier mit einem Ankerapparat in der Wirtslarvenhaut. Die Eier tragen einen zentralen, scheibenförmigen Ankerappa-

Tabelle 1: Anzahl Eier pro Wirtslarve und Parasitierungsraten (in %) von *Tersilochus* sp. n. an *E. unimaculella* in Norddeutschland (1), in Hessen (2), im Elsaß (3) und im Wallis (4).

Standort	Jahr	Anzahl Eier pro Wirtslarve				Parasitierungsrate (%)
		0	1	2	3	
Dieburg (2)	1991	50	25	2	0	35,1
Kiel (1)	1987	337	128	13	5	30,2
Vellescot (3)	1991	48	6	0	0	11,1
Sierre (4)	1992	210	21	4	0	10,6
Hammoor (1)	1989	65	5	0	0	7,1
Bordelum (1)	1989	98	3	1	0	3,9
Hammoor (1)	1991	821	5	0	0	0,6

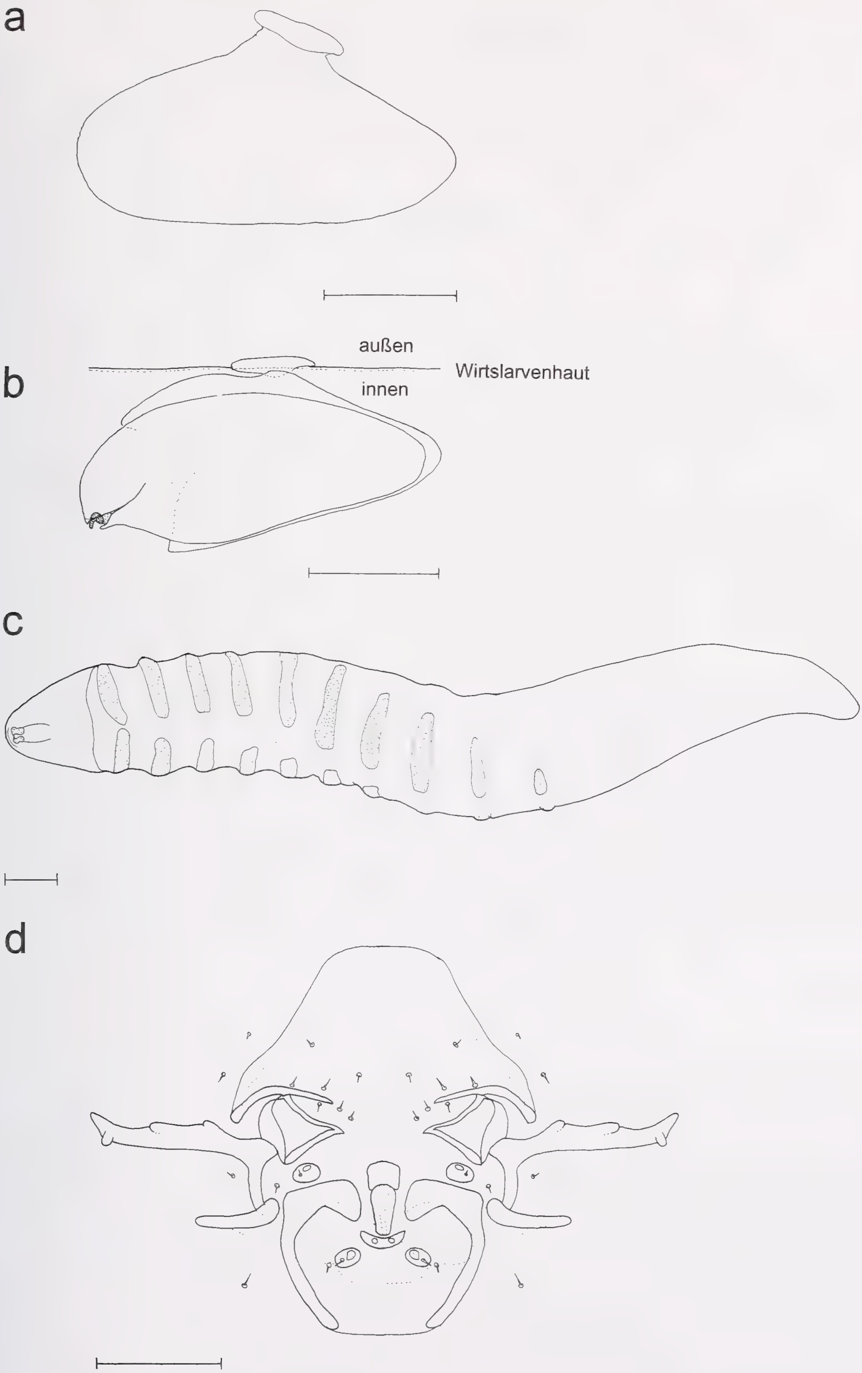

Abb. 2: Jugendstadien von *Tersilochus* sp. n.; Wirt: *E. unimaculella*. a) Eiform, b) Erstlarve in der Eihülle, c) Junglarve (L_2), d) Kopfsklerite der Altlarve. Maßstab jeweils 0.1 mm.

Tabelle 2: Verteilung abgelegter *Tersilochus* sp. n.-Eier an *E. unimaculella*-Larven.

Ablageort	Thorax- I	II	III	Abdomensegment 4	5	6	7	8	9	10	11	12	13	Summe
dorsal	64	24	2	0	0	0	0	1	1	0	0	1	0	93
lateral	67	25	5	3	1	0	0	2	3	1	1	1	0	109
ventral	38	8	0	0	0	0	1	1	0	0	0	0	0	48
Summe	169	57	7	3	1	0	1	4	4	1	1	2	0	250

rat, mit dem sie innen in der Larvenhaut befestigt werden, wobei der Anker die Eiablagestelle verschließt (Abb. 2a). Die hellbraun gefärbten, am cephalen Pol farblosen Eier waren bevorzugt im Thorakalbereich der Wirtslarven abgelegt (93 % aller Eiablagen, Tab. 2) und durch die Wirtslarvenhaut hindurch sichtbar. Die Parasitoidenlarven verbleiben einige Zeit in der Eischale (Abb. 2b) und fressen im Haemocoel des Wirtes. Die Entwicklung der Parasitoidenlarven in den Wirten wurde nur an wenigen Individuen verfolgt. Neun Tage nach dem Abwandern der Wirtslarven hatte sich 1 von 3 *Tersilochus* sp. n.-Erstlarven zur L_2 (Abb. 2c) entwickelt. Drei Wochen nach dem Abwandern der Wirte wurden 2 L_1 und 10 L_2 in ihren Wirtslarven aufgefunden. Mitte August, etwa 12 Wochen nach dem Abwandern der Wirte, spannen sich die *Tersilochus* sp. n.-Altlarven (Kopfkapsel siehe Abb. 2d) in ihren Kokon ein. Die Imagines schlüpfen im Herbst und überwintern im Kokon. Im Oktober vorzeitig befreite Individuen liefen träge umher, waren aber offensichtlich noch nicht flugfähig. Imagines aus norddeutschen Proben schlüpften bei angenäherten Außentemperaturen zwischen dem 27. März und dem 2. April 1988 (n = 12). Die Lebensspanne umfaßte 16 bis 36 Tage, im Mittel 27 ± 4 S.E. Tage (bei natürlichen Lichtverhältnissen und Temperaturen, mit Rosinen und Wasser gefüttert). Im allgemeinen schlüpften die Imagines im darauffolgenden Jahr nach der Probennahme (Zuchten 1988–1994, n = 70). Lediglich 2 Individuen schlüpften 3 und 4 Jahre nach der Aufsammlung aus den Larvenproben, waren also in eine verlängerte Diapause eingetreten.

Diskussion

Die beiden untersuchten *Tersilochus*-Arten lassen sich als strikt monophage Larvenparasiten von *E. cicatricella* und *E. unimaculella* charakterisieren. Die vollständige Kongruenz von Wirtswahl und Wirtsbelegung mit den unterschiedlichen Eiformen bestätigt die hohe Spezifität der Parasitoiden. Sie haben zudem eine unterschiedliche Stadienspezifität. *Tersilochus curvator* parasitiert bereits Junglarven (L_1 und L_2) von *E. cicatricella*. Da im Wallis keine Zunahme der Parasitierung durch *T. curvator* bei älteren Larvenstadien im Vergleich zu jüngeren *E. cicatricella* nachgewiesen wurde, scheint die Eiablage in einem kurzen Zeitraum zu Beginn der Wirtslarvenentwicklung zu erfolgen. *Tersilochus* sp. n. hingegen befällt *E. unimaculella* erst am Ende der Larvenentwicklung, kurz vor dem Abwandern der Wirte aus ihren Minen, wie in Kiel festgestellt wurde. Neben der Wirtswahl, der unterschiedlichen Stadienspezifität und divergierenden Abundanz der beiden *Tersilochus*-Arten unterstützen

Merkmale der Parasitoiden-Jugendstadien, wie unterschiedliche Eiformen und Kopfsklerite der Altlarven, zusätzlich die Zuordnung der gezüchteten Parasitoiden-Imagines zu unterschiedlichen Arten.

Die erfolgreiche Parasitierung bei niedrigen Wirtsdichten weist auf ein hohes Wirtsfindevermögen der *Tersilochus*-Weibchen hin, die außerdem in der Lage sind, zwischen den einzelnen *Eriocrania*-Wirtsarten zu unterscheiden. Eine Diskrimination bereits parasitierter Wirtslarven zur Verminderung innerartlicher Konkurrenz, wie sie bei vielen echten Schlupfwespen (Ichneumonidae) verbreitet ist, manifestiert sich im allgemeinen durch niedrige Superparasitierungsraten sowie eine geringe Anzahl Eier pro Wirt bei mehrfachen Belegungen (Pschorn-Walcher 1985). Für *T. curvator* wurden fast ausschließlich Solitärparasitierungen und für *Tersilochus* sp. n. gelegentliche Superparasitierungen mit höchstens drei Eiern pro Wirtslarve festgestellt. Jedoch entsprach die Verteilung der Parasitoideneier in den jeweiligen Wirtslarvenpopulationen einer Zufallsverteilung (Verteilung nicht signifikant unterschiedlich zu einer Poisson-Verteilung). Somit erscheint für die beiden *Tersilochus*-Arten ein entsprechendes Diskriminationsvermögen fraglich.

Die Entwicklungsbiologie von *T. curvator* und *Tersilochus* sp. n. entspricht weitgehend jener anderer *Tersilochus*-Arten, die sich an versteckt lebenden Wirten entwickeln (Gauld & Bolton 1988). Beide Endoparasiten verzehren den Wirt im Kokon im Boden, spinnen einen eigenen Kokon und verpuppen sich noch im Sommer. Die Imagines schlüpfen vor der Überwinterung, verbleiben aber bis zum Ausschlupf im Wirtskokon.

Das Verbreitungsareal der untersuchten *Eriocrania*-Wirtsarten erstreckt sich über ganz Europa. Davis (1978) gibt das Vorkommen der an Birken minierenden *Eriocrania*-Arten von der Baumgrenze am Polarkreis bis zu den Alpen und bis nach Asien hin an. Imagines von *T. curvator* sind im nördlichen Verbreitungsgebiet ihres Wirtes bekannt (Horstmann 1981) und wurden hier zusätzlich für das Elsaß und die Schweiz nachgewiesen. In höheren Lagen des Schwarzwaldes und im Waldviertel war die Wirtsart *E. cicatricella* nicht oder nur in geringen Dichten vorhanden (Jordan 1992), so daß nicht sicher beurteilt werden kann, ob *T. curvator* dort vorkommt. *Tersilochus* sp. n. war dagegen regelmäßig in allen untersuchten Regionen mit *E. unimaculella*-Befall vertreten.

Die Verankerung der *Tersilochus* sp. n.-Eier in den Wirtslarven scheint eine Besonderheit innerhalb der Gattung zu sein. Allerdings sind erst von wenigen *Tersilochus*-Arten die Wirtsbeziehungen bekannt (Horstmann 1971, 1981), so daß hier keine endgültigen Aussagen gemacht werden können. Einige Arten der nahe verwandten Gattung *Diasparsis* (Ichneumonidae, Tersilochinae) besitzen knopfförmige Anker oder sehr kleine Anheftestellen an den Eiern und werden ebenfalls auf der Innenseite der Wirtslarvenhaut befestigt (Dysart et al. 1973). Ausschlüpfende *Diasparsis*-Larven und zum Teil auch ältere Larvenstadien fressen aus der fixierten Eischale heraus im Haemocoel des Wirtes, was von Parker & Berry (1950) als Verteidigung gegen aggressive endoparasitische Konkurrenten gedeutet wird. Daneben gibt es *Diasparsis*-Arten, deren Eier keine Befestigungsstrukturen aufweisen und die frei im Haemocoel der Wirtslarven flottieren (Dysart et al. 1973; Montgomery & DeWitt 1975). Unter den *Tersilochus*-Arten weisen z. B. die gut untersuchten Arten *T. conotracheli* Riley und *T. melanogaster* Thoms. Eier ohne Befestigungsstrukturen auf (Cushman 1916, Jourdheuil 1960), wie sie auch bei *T. curvator* vorgefunden wurden.

Tersilochinae sind im allgemeinen spezialisierte Endoparasiten phytophager Käferlarven, die sich im Boden verpuppen, oder von phylogenetisch „altertümlichen“ Blattwespen wie den Xyelidae (Gauld & Bolton 1988). Davis (1978) nennt eine (fragliche) *Tersilochus*-Art als Parasitoid der nearktischen Trugmotte *Dyseriocrania griseocapitella* (Wals.) (Eriocraniidae). Inwiefern eine Adaptation an die phylogenetisch ursprünglichen *Eriocrania*-Arten erfolgte und die Frage, warum an den gleichzeitig an Birken minierenden Arten *E. sangii* und *E. semipurpurella* keine *Tersilochus*-Arten leben, muß zunächst offen bleiben. Der bisher spärliche Kenntnisstand über die übrigen europäischen Trugmottenarten sowie deren assozierte Parasitoiden lassen in Zukunft die Entdeckung neuer Parasitoidenarten erhoffen und damit fundiertere Aussagen über das Ausmaß der Wirtsbeziehungen der *Tersilochus*-Arten zu den phylogenetisch ursprünglichen *Eriocrania*-Arten erwarten.

Danksagung

Mein Dank gilt Prof. Dr. H. Pschorn-Walcher, Neulengbach, Österreich, für die Anregung zu dieser Arbeit und die Durchsicht des Manuskriptes. Weiterhin danke ich Prof. Dr. K. Horstmann, Würzburg, für die Bestimmung der *Tersilochus*-Arten und Dr. E. Altenhofer, Groß Gerungs, Österreich, für die Unterstützung bei der Probennahme im Waldviertel. Ein Teil dieser Arbeit wurde von der Deutschen Forschungsgemeinschaft finanziert (P/S 7-3/1, 1990).

Zusammenfassung

Tersilochus-Arten (Ichneumonidae, Tersilochinae) waren bisher als koinobionte Endoparasiten versteckt lebender Käferlarven (Coleoptera, hauptsächlich Curculionidae und Nitidulidae) bekannt. Hier werden erstmals Wirtsbeziehungen zu in Birkenblättern minierenden Trugmotten (Lepidoptera, Eriocraniidae), einer phylogenetisch ursprünglichen Kleinschmetterlingsgruppe, vorgestellt. Der Parasitoid *Tersilochus curvator* wurde aus *Eriocrania cicatricella* und eine noch unbeschriebene Art, *Tersilochus* sp. n., aus *Eriocrania unimaculella* gezüchtet. Beide Parasitoiden-Arten befallen die Wirtslarven im Frühjahr in den Blattminen und entwickeln sich im Wirtskokon im Boden weiter. Die Imagines verbleiben vom Herbst bis zum Ausschlupf im darauffolgenden Frühjahr im Kokon. *Tersilochus curvator* parasitiert bereits Junglarven von *E. cicatricella*, während *Tersilochus* sp. n. ältere Larvenstadien von *E. unimaculella* belegt, wobei die mit einem Ankerapparat versehenen Eier unter der Larvenhaut befestigt werden. Befallene Wirtslarven wurden in Nord- und Süddeutschland, Österreich, dem Elsaß und im Wallis nachgewiesen.

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Gorbothorax n. gen., a new linyphiid spider genus from the Nepal Himalayas (Arachnida, Araneae, Linyphiidae)[1]

Andrei V. Tanasevitch

Abstract. A new spider genus, *Gorbothorax* n. gen., and four new species, *comatus* n. sp. (the type species), *conicus* n. sp., *setifer* n. sp., and *ungibbus* n. sp., are described from the Nepal Himalayas. One more species is transferred to *Gorbothorax*, i. e. *maculatus* (Wunderlich, 1974), comb. n. ex *Oedothorax* Bertkau, 1883.

Key words. Arachnida, Linyphiidae, taxonomy, Nepal.

This work continues my studies on the linyphiid fauna of Nepal, this time devoted to the description of a new genus and a few new species. Holo- and the majority of paratypes have been deposited in the Senckenberg Museum, Frankfurt a. M. (SMF), some paratypes have become part of the collections of the Zoological Museum of the Moscow State University, Moscow (ZMMU) and the Zoologisches Forschungsinstitut und Museum A. Koenig, Bonn (ZFMK).

The following abbreviations are used in the text and the figures: Ti — tibia, Mt — metatarsus, Tm I — position of the metatarsal trichobothrium, ED — embolic division, SA — suprategular apophysis.

Chaetotaxy is given in the following formula: 2.2.1.1 refers to the number of dorsal spines on Ti I—IV. The sequence of leg segments in the measurement data is as follows: femur + patella + tibia + metatarsus + tarsus. All measurements are given hereinafter in mm. Scale — 0.1 mm, if not otherwise indicated.

Gorbothorax n. gen.

Type species: *Gorbothorax comatus* n. sp.

Etymology: The generic name refers to the specific shape of the male carapace, both deriving from *gorb* (in Russian meaning "hump"), and Latin *thorax*.

Diagnosis: The genus is characterized by the combination of the following features: chaetotaxy 2.2.1.1, presence of a trichobothrium on Ti IV and its distal position on Ti I, large paracymbium, large, complete and well sclerotized suprategular apophysis, the embolic division divided into two separate sclerites, embolus long and thin.

Description: Medium-sized erigonines, total length 1.80—2.60, with a pale brown coloration and a distinct abdominal pattern. Male carapace modified (except in *ungibbus* n. sp.). Chelicerae proportionate in size with cephalothorax, unmodified,

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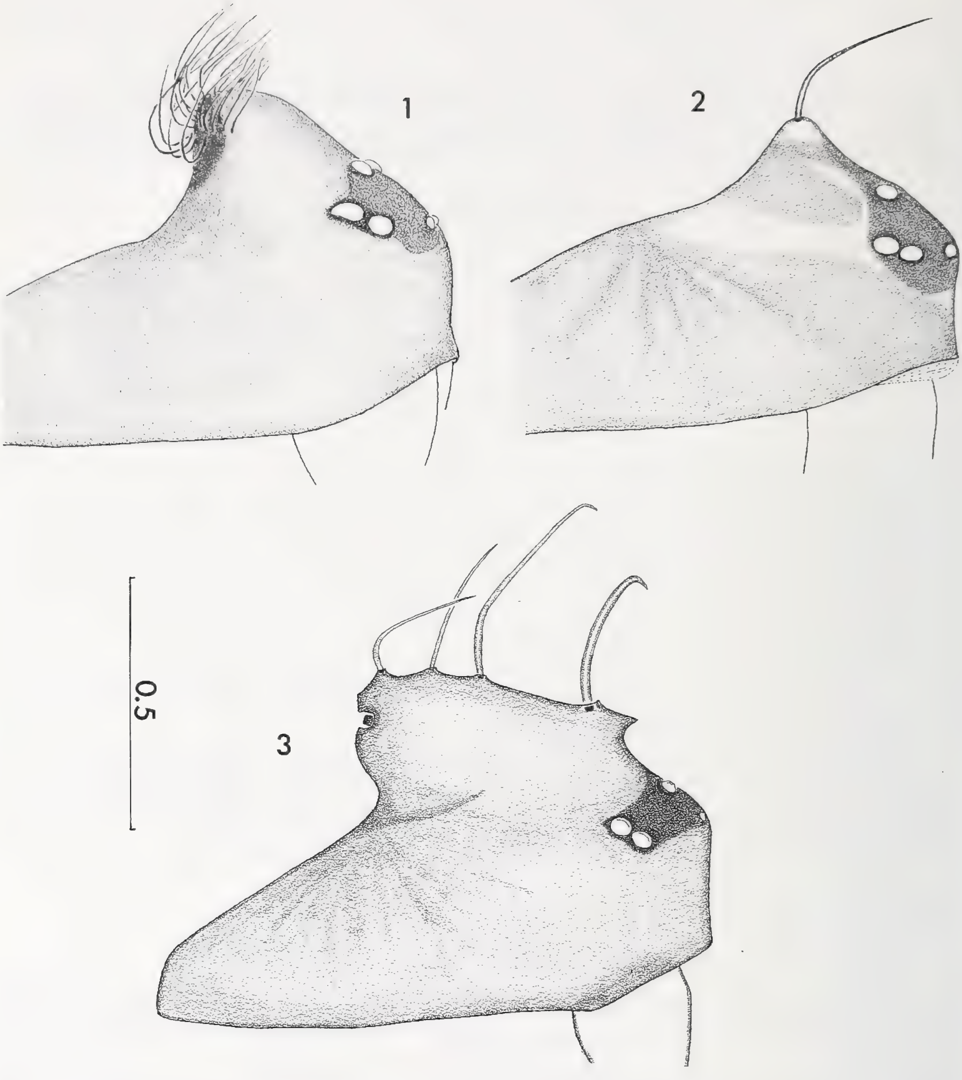
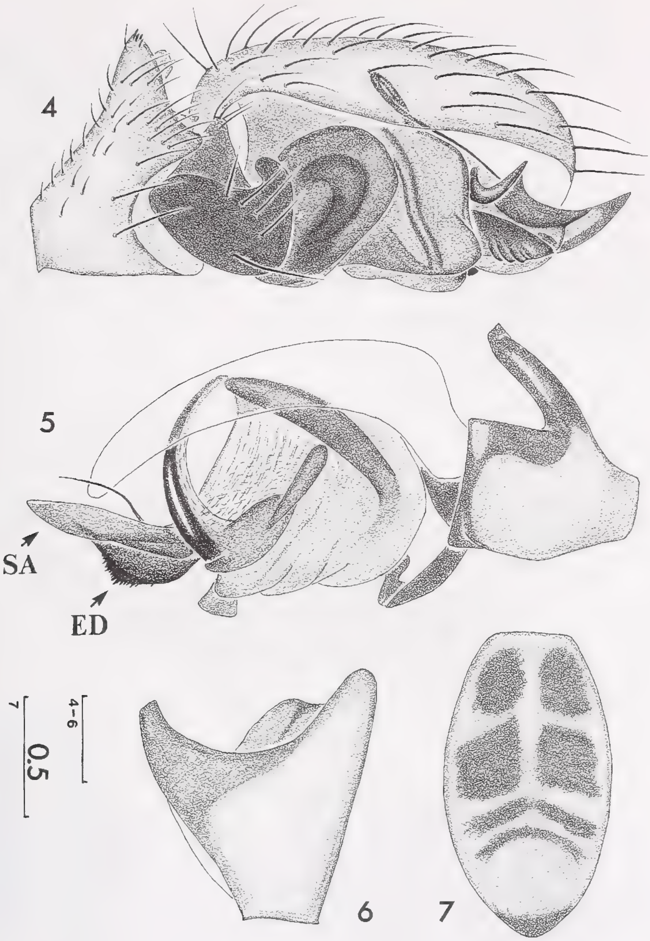


Figs 1—3: Male carapace of *Gorbothorax* spp. — 1) *comatus* n. sp., paratype from Mai Pokhari; 2) *conicus* n. sp., holotype; 3) *setifer* n. sp., holotype.

without frontal tooth. Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I: 0.70—0.85. Palpal tibia modified, with two outgrowths: a thick and rounded dorso-retrolateral as a rule bearing a few very short, thick, terminal spines, and a dorso-prolateral one. Paracymbium relatively large, black, carrying several spines in distal part. Suprategular apophysis well-developed and sclerotized, complex in shape. Embolic division divided into two separate sclerites connected with short, poorly visible membrane. The first sclerite — embolus — long, thin and curved. The second



Figs 4—7: *Gorbothorax comatus* n. sp., male paratype from Mai Pokhari. — 4,5) right palp; 6) palpal tibia (dorsal view); 7) abdomen (dorsal view).

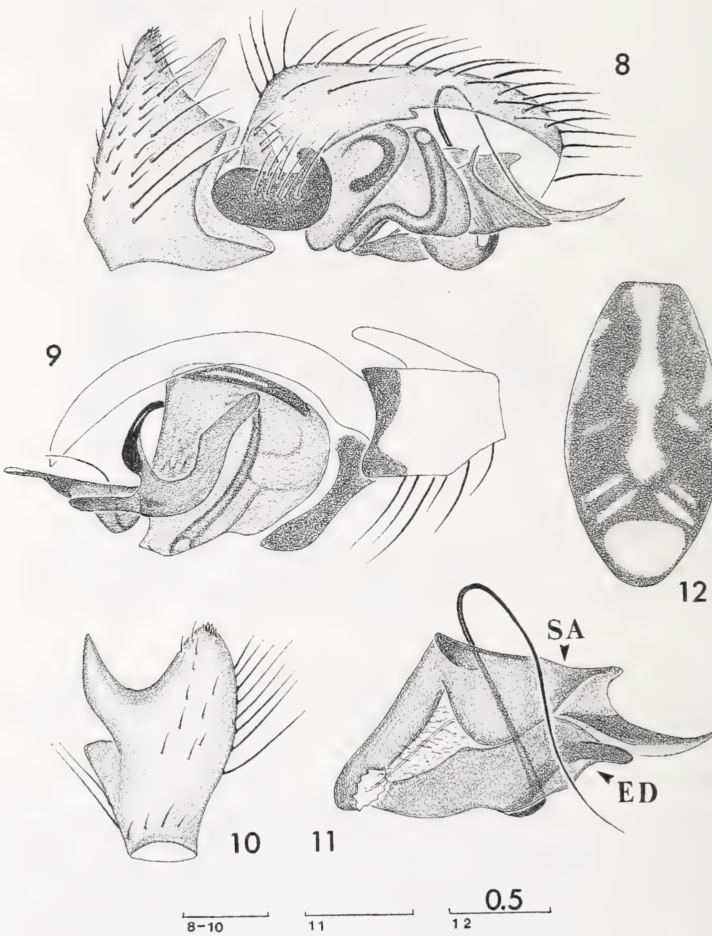
one is relatively large, well sclerotized and elongated. The latter was previously called by Merrett (1963) "lamella", and as this term was wittingly invalid, the author and followers have used it in quotation marks. For this separated sclerite of the embolic division, which connects with the embolus by the membrane, I propose a new term, convector, which in Latin means "companion". This term may apply at least to the closely related genera of the *Gongilidium* genus group of Millidge (1977), *Oedothorax* Bertkau, 1883, *Gongylidium* Menge, 1868, *Gongylidioides* Oi, 1960 and *Gorbothorax* n. gen. In these genera this sclerite is obviously homologous.

Taxomonic remarks: This genus is a member of the *Gongylidium* genus group of Millidge (1977) and closely related to the Far-Eastern *Gongylidioides*. *Gorbotho-*

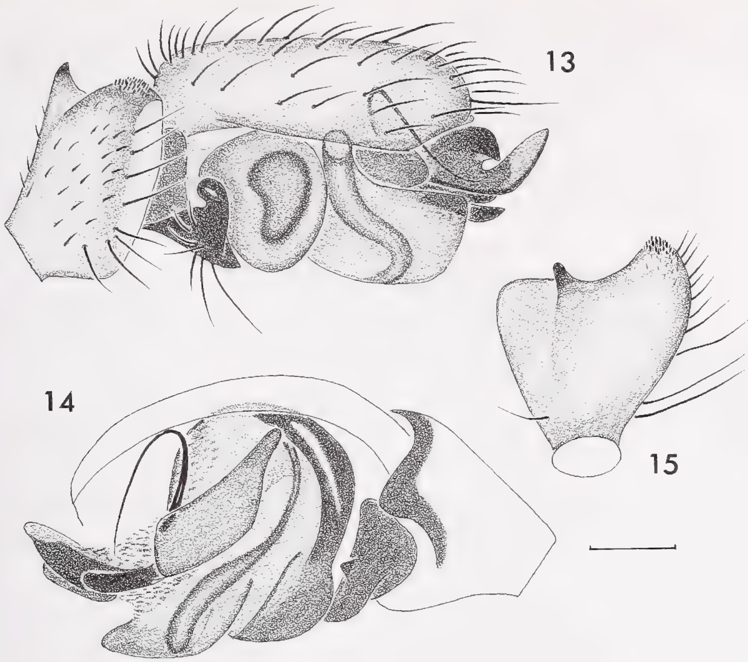
rax n. gen. differs by the shape of the convector (elongate and without outgrowth) and a curved embolus. From *Oedothorax*, another closely related genus, the new genus differs by a well-developed and sclerotized suprategular apophysis and a long embolus.

Species included: The new genus currently comprises five species, four of them being new to science. These are *comatus* n. sp., *conicus* n. sp., *setifer* n. sp., and *ungibbus* n. sp., as well as *maculatus* (Wunderlich, 1974), comb. n. ex *Oedothorax*.

Distribution. All species of *Gorbothorax* are distributed in the Nepal Himalayas. The close relation to *Gongylidioides* demonstrates important relationships between Himalayan and East Asian faunas.



Figs 8—12: *Gorbothorax conicus* n. sp., male paratype from Omje Kharka. — 8,9) right palp; 10) palpal tibia (dorsal view); 11) embolic division; 12) abdomen (dorsal view).



Figs 13—15: *Gorbothorax setifer* n. sp., male holotype. — 13,14) right palp; 15) palpal tibia (dorsal view).

Gorbothorax comatus n. sp. (Figs 1, 4—7)

Material: Holotype male (SMF), Nepal, Panchthar Distr., Paniporua, 2300 m, mixed broadleaved forest, 16.—20. IV. 1988, leg. J. Martens & W. Schawaller. — Paratypes: 4 males (SMF), 1 male (ZFMK), 1 male (ZMMU), same locality, together with holotype; 2 males (SMF), Ilam Distr., Mai Pokhari, 2100—2200 m, forest, 25.—27. III. 1980, leg. J. Martens & A. Ausobsky; male (SMF), Panchthar Distr., between Paniporua and Hinwa Khola Valley, 1850—2300, cultivated land, tree-rich, 20. IV. 1988, leg. J. Martens & W. Schawaller; 2 males (SMF), Taplejung Distr., Yamputhin, cultivated land, open forest, 1650—1800, 26. IV.—1. V. 1988, leg. J. Martens & W. Schawaller.

Etymology: The specific name can be translated from Latin as "shaggy".

Diagnosis: The new species is well recognizable by the specific shape of the male carapace, as well as by the shape of the frontal part of the convector, which carries numerous small, pointed teeth.

Description: Male (female unknown). Total length 2.33. Carapace 1.13 long, 0.80 wide, pale reddish-brown. Cephalic part of carapace behind eye area with a hump-shaped elevation carrying numerous long, curved spines (Fig. 1). Chelicerae 0.40 long. Legs pale brown. Leg I 4.01 long (1.10 + 0.30 + 1.03 + 0.95 + 0.63), IV—4.10 long (1.15 + 0.30 + 1.05 + 1.05 + 0.55). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I—0.70. Palp (Figs 4—6): Dorso-retrolateral outgrowth of tibia conical, with several very shot spines terminally, dorso-prolateral outgrowth blunt. Paracymbium large, dark, carrying a few spines in distal part. Frontal part of convector black, with numerous small teeth. Abdomen 1.23 long, 0.85 wide, pattern as in Fig. 7.

Taxomomic remarks: This species is closely related to *conicus* n. sp., being well distinguished by the shape of the cephalic elevation, frontal process of the embolic division (narrow and toothless in *conicus* n. sp., thick and serrate in *comatus* n. sp.), and longer embolus.

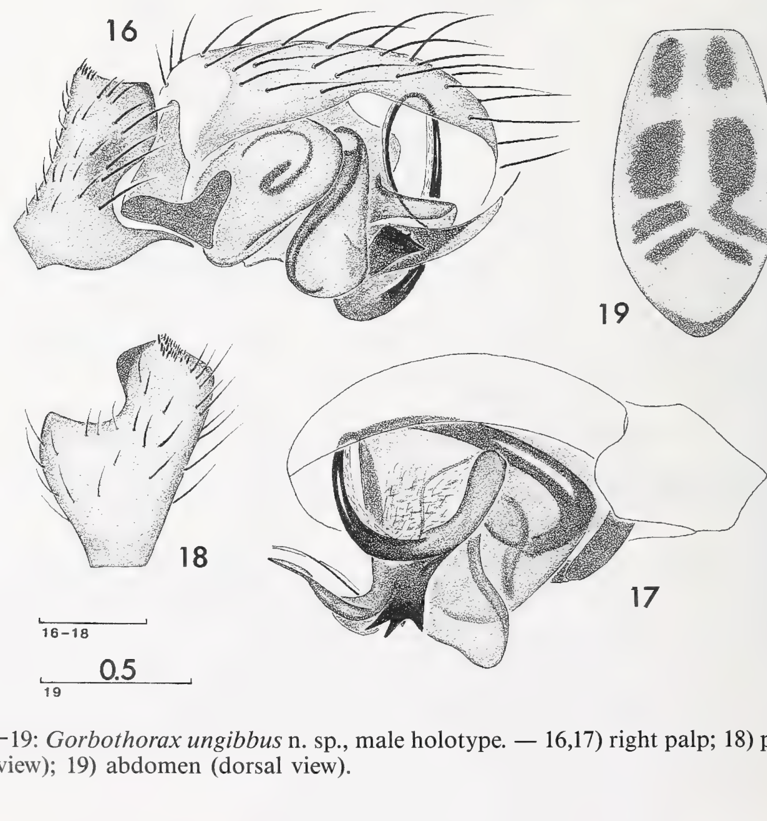
Gorbothorax conicus n. sp. (Figs 2, 8—12)

Material: Holotype male (SMF), Nepal, Taplejung Distr., ridge Lasse Dhara und pasture Lassetham, 3000—3300 m, 6—7. IX. 1983, leg. J. Martens & B. Daams. Paratype: male (ZFMK), Taplejung Distr., Omje Kharka NW Yamputhin, natural mixed broadleaved forest, 2300—2500 m, 1.—6. V. 1988, leg. J. Martens & W. Schawaller.

Etymology: The specific name describes the shape of the male cephalic elevation.

Diagnosis: The new species is well recognizable by the specific shape of the male carapace, as well as by the shape of the palpal tibia and long, narrow and pointed distal part of the suprategular apophysis.

Description: Male (female unknown). Total length 2.43. Carapace 0.93 long, 0.75 wide, pale reddish-brown. Cephalic part of carapace partly depigmented, with a conical "hump" behind eye area carrying long, strongly curved setae (Fig. 2). Chelicerae 0.45 long. Legs pale brown. Leg I 3.39 long (0.93 + 0.28 + 0.83 + 0.80 + 0.55), IV—3.46 long (0.95 + 0.25 + 0.85 + 0.88 + 0.53). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I—0.70. Palp (Figs 8—11): Dorso-retrolateral outgrowth of tibia conical, with several very shot spines terminally, dorso-prolateral outgrowth pointed. Paracymbium dark, carrying a few spines in



Figs 16—19: *Gorbothorax ungibbus* n. sp., male holotype. — 16,17) right palp; 18) palpal tibia (dorsal view); 19) abdomen (dorsal view).

Fig. 20: Collecting sites of *Gorbothorax* species in Nepal (Martens collection). — 1) between ridge Lassedara and pasture Lassetham, also Omje Kharka (*G. conicus* n. sp.); 2) Yamputhin (*G. comatus* n. sp.); 3) Tinjura Dara (G. *setifer* n. sp.); 4) Paniporua and descent to Hinwa Khola (*G. comatus* n. sp.); 5) Mai Pokhari (*G. comatus* n. sp.); 6) Sanishare (*G. ungibbus* n. sp.). — According to species: *G. comatus* n. sp.: 2, 4, 5; *G. conicus* n. sp.: 1; *G. setifer* n. sp.: 3; *G. ungibbus* n. sp.: 6.

distal part. Suprategular apophysis large, distally elongate to slightly curved and pointed. Frontal part of convector narrow, toothless. Abdomen 1.53 long, 0.95 wide, dorsal pattern as in Fig. 12.

Taxomomic remarks: This species is closely related to *comatus* n. sp. (see above).

Gorbothorax setifer n. sp. (Figs 3, 13—15)

Material: Holotype male (SMF), Nepal, Terhathum Distr., Tinjura Dara, 2450—2850 m, species-rich broadleaved forest, Berlese funnels, 17. IX. 1983, leg. J. Martens & B. Daams.

Etymology: The specific name is derived from both seta meaning a "strong spine", and ferens meaning "bearing".

Diagnosis: The new species is well distinguishable from other congeners by the very peculiar shape of the carapace, structure of the palpal tibia, as well as by the shape of the supategular apophysis.

Description: Male (female unknown). Total length 2.55. Carapace 1.20 long, 0.85 wide, greyish-brown, modified as in Fig. 3. Chelicerae 0.50 long. Legs pale brown. Leg I 4.22 long (1.18 + 0.33 + 1.05 + 1.03 + 0.63), IV—4.27 long (1.23 + 0.30 + 1.03 + 1.13 + 0.58). Chaetotaxy 2.2.1.1, leg spines very short. Each metatarsus with a trichobothrium. Tm I—0.77. Palp (Figs 13—15): dorso-retrolateral outgrowth of tibia rounded, with numerous, very short, barb-like spines terminally, dorso-prolateral outgrowth small. Distal part of paracymbium narrow, dark, carrying a few spines. Supategular apophysis large, complex in shape. Frontal part of convector narrow, dark. Abdomen 1.38 long, 0.88 wide, dark grey, dorsal pattern very vague.

Oedothorax ungibbus n. sp. (Figs 16—19)

Material: Holotype male (SMF), Nepal, Ilam Distr., Sanishare, 5 km N, feet of Siwalik Mts., 270—300 m, mixed *Shorea* forest, 3.—5. IV. 1988, leg. J. Martens & W. Schawaller.

Etymology: The specific name describes the shape of the male carapace referring to the absence of a "hump".

Diagnosis: The new species is diagnosed by the unmodified male carapace, relatively small and spineless paracymbium, very long and curved embolus, as well as by the shape of the frontal part of the convector.

Description: Male (female unknown). Total length 1.83. Carapace 0.85 long, wide, 0.68, greyish-yellow, unmodified. Chelicerae 0.38 long. Legs pale yellow. Leg I—3.23 long (0.88 + 0.24 + 0.85 + 0.78 + 0.48), IV—3.13 long (0.85 + 0.20 + 0.80 + 0.83 + 0.45). Chaetotaxy 2.2.1.1. TmI—0.84. Palp (Figs 16—18): Dorso-retrolateral outgrowth of tibia with several very short spines terminally. Paracymbium relatively small, spineless. Suprategular apophysis complex in shape, distally pointed. Embolus very long and curved. Frontal part of the convector with several large black teeth. Abdomen 1.03 long, 0.65 wide, dorsal pattern as in Fig. 19.

Gorbothorax wunderlichi (Brignoli, 1983) comb. n.

Oedothorax maculatus Wunderlich, 1974. Senckenbergiana biol. 55: 185, figs 51—58.
Oedothorax wunderlichi Brignoli, 1983. A Catalogue of the Araneae: 324, nom. nov. pro *Oedothorax maculatus* Wunderlich, 1974, praeocc.

This species was described from East Nepal by Wunderlich (1974) as *Oedothorax maculatus* Wunderlich, 1974. According to the above author's figures, this is a good member of *Gorbothorax*, comb. n. ex *Oedothorax*.

The collecting sites of all species mentioned are shown in Fig. 20.

Acknowledgements

I am very grateful to Prof. J. Martens (Mainz) and Dr. W. Schawaller (Stuttgart), whose collections served as the basis for the present paper. In addition, Dr. S. I. Golovatch (Moscow) kindly checked the English of the final draft. This work was partly supported by the Soros Foundation ("Biodiversity").

Zusammenfassung

Auf der Basis von in Nepal gesammelten Materials wird die Spinnengattung *Gorbothorax* n. gen. mit den vier Arten *comatus* n. sp. (Typusart), *conicus* n. sp., *setifer* n. sp., und *ungibbus* n. sp. beschrieben. Eine weitere Art wird von *Oedothorax* Bertkau, 1883 nach *Gorbothorax* transferiert.

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Wunderlich, J. (1974). Linyphiidae aus Nepal. II. Die Gattung *Oedothorax* Bertkau 1833 (Arachnida, Araneae). — Senckenbergiana biol. 55: 169—188.

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New *Oedothorax* Bertkau, 1883, from Nepal (Arachnida, Araneae, Linyphiidae)[1)]

Andrei V. Tanasevitch

Abstract. Eleven new species of the spider genus *Oedothorax* Bertkau, 1883, from the Nepal Himalayas are described.

Key words. Arachnida, Linyphiidae, new species, Nepal.

The spider genus *Oedothorax* Bertkau, 1883, seems to be one of the most speciose among Himalayan erigonines. From various parts of the Himalayas, no fewer than 12 species of this genus have hitherto been described: *dubius* Caporiacco, 1935 (from a juvenile specimen) from Karakorum (Caporiacco 1935); *annulatus* Wunderlich, 1974, *asocialis* Wunderlich, 1974, *dismodicoides* Wunderlich, 1974, *elongatus* Wunderlich, 1974, *hirsutus* Wunderlich, 1974, *lineatus* Wunderlich, 1974, *lucidus* Wunderlich, 1974, *sexoculatus* Wunderlich, 1974, *unicolor* Wunderlich, 1974, and *wunderlichi* Brignoli, 1983, all from Nepal (Wunderlich 1974, Brignoli 1983), and *globiceps* Thaler, 1987, from Kashmir (Thaler 1987). This paper augments the Nepalese fauna by another 12 new *Oedothorax*. Although many females are present in the material, the majority of the descriptions are based on the male sex only. The reason for that lies in the difficulty to match the male with the proper female when several congener candidates are plausible, all deriving from the same sample.

Contrary to numerous Far Eastern or African *Oedothorax*, which seem to actually belong to other genera, the Himalayan fauna appears to comprise a swarm of species clearly congeneric with the type-species, *Oedothorax gibbosus* (Blackwall, 1841). However, *wunderlichi* Brignoli, 1983 (nomen novum pro *Oedothorax maculatus* Wunderlich, 1974, praeocc.) proves to be a member of another genus.

In 1974 J. Martens stated (in Wunderlich 1974: 171) that the eleven species of *Oedothorax* described in that paper originated from a comparatively narrow vertical area belt of the southern macroslope of the Nepal Himalayas, the localities being situated between 1700 and 2900 m. They comprise the subtropical evergreen mountain forest and the evergreen cloud forest communities. J. Martens collected, however, during his long-lasting stays in Nepal also at altitudes even above 5500 m (Martens 1987), but no *Oedothorax* species showed up above 3000 m, namely the Palaearctic part of the Nepal Himalayas. All *Oedothorax* localities are heavily influenced by monsoon precipitations (except lake Titi, which is on the borderline to drier habitats). In dry rain shadow areas north of the Himalayan main chain, no representative of the genus was discovered.

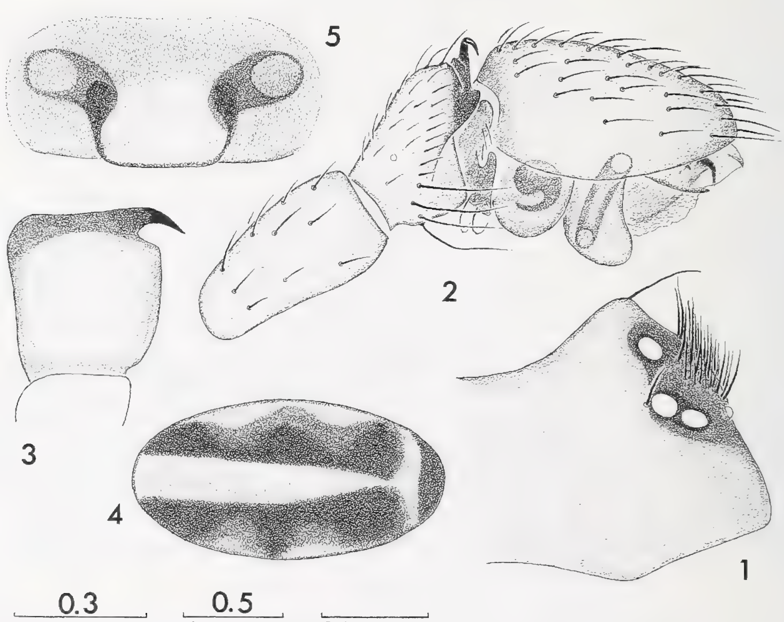
[1)] Results of the Himalaya Expeditions of J. Martens, No 217. — For No. 216, see Bonn. zool. Beitr. 47, 1998. — J.M. sponsored by Deutscher Akademischer Austauschdienst and Deutsche Forschungsgemeinschaft.

The new records of eleven further *Oedothorax* species, which are presented here, fall, too, exactly into this distribution scheme. Again, no record is higher than 3000 m, the lowest, as already indicated by Wunderlich (1974), no lower than 1700 m, but these belong well to the subtropical belt. In general, *Oedothorax* in Nepal shows no clear-cut affinities to Palaearctic climate and biotopes, and it is to be questioned how close the affinities to the true Palaearctic species set of the genus really are.

Holo- and the majority of paratypes have been deposited in the Senckenberg Museum, Frankfurt a. M. (SMF), some duplicate paratypes have become part of the collections of the Zoological Museum of the Moscow State University, Moscow (ZMMU) and Zoologisches Forschungsinstitut und Museum A. Koenig, Bonn (ZFMK).

The following abbreviations have been accepted in the text and figures: Ti — tibia, Mt — metatarsus, Tm I — position of the metatarsal trichobothrium, AME — anterior, and PME — posterior median eyes, respectively.

Chaetotaxy is given in the following formula: 2.2.1.1 refers to the number of dorsal spines on Ti I—IV. The sequence of leg segments in the measurement data is as follows: femur + patella + tibia + metatarsus + tarsus. All measurements are given hereinafter in mm. Scale — 0.1 mm, if not otherwise indicated.



Figs 1—5: *Oedothorax assuetus* n. sp., male and female paratypes. — 1) male carapace (lateral view); 2) right palp; 3) palpal tibia (dorsal view); 4) male abdomen (dorsal view); 5) epigynum.

Oedothorax assuetus n. sp., Figs 1—5.

Material: Holotype male (SMF), Nepal, Kathmandu, Godawari, foot of Phulchoki Mt., 1700 m, 19. III. 1980, leg. J. Martens & A. Ausobsky. — Paratype: 1 male (SMF), same locality, together with holotype, leg. J. Martens & A. Ausobsky.

Diagnosis: The new species is diagnosed by the shape of the male carapace's cephalic elevation and structure of the palpal tibia. The epigyne is of ordinary shape and close to many other congeners.

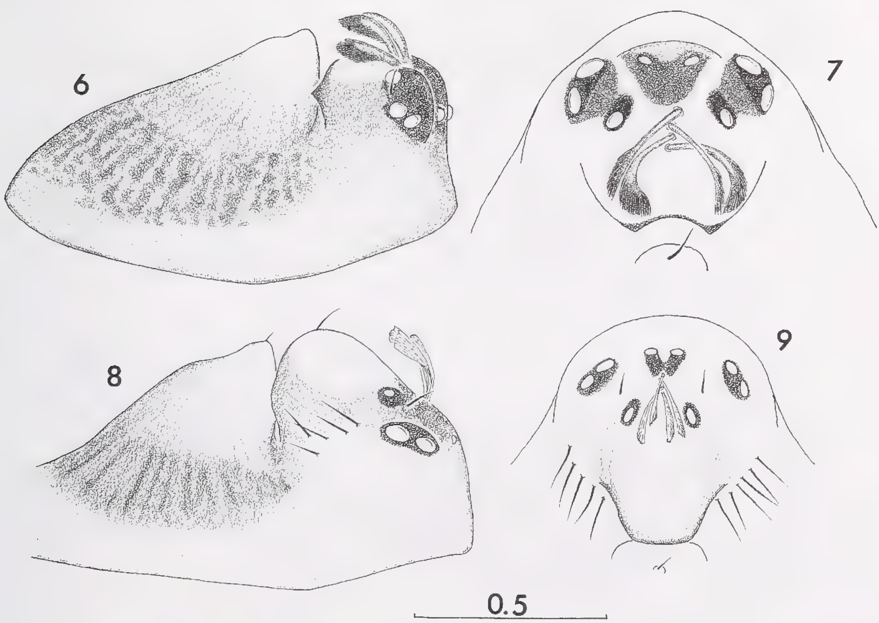
Etymology: The specific name *assuetus* is a Latin adjective meaning "ordinary", referring to the common shape of the epigyne.

Description: Male. Total length 2.38. Carapace (Fig. 1) 1.08 long, 0.75 wide, pale brown, with a wide dark ring (except for cephalic division). Chelicerae 0.48 long. Legs pale brown. Leg I — 3.62 long (0.95 + 0.88 + 0.28 + 0.88 + 0.63), IV — 3.68 long (1.00 + 0.95 + 0.28 + 0.95 + 0.50). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I — 0.57. Palp as in Figs 2—3. Abdomen 1.53 long, 0.90 wide, dorsal pattern as in Fig. 4.

Female. Total length 2.45. Carapace 1.03 long, 0.70 wide, unmodified. Chelicerae 0.45 long. Leg I — 3.39 long (0.93 + 0.85 + 0.30 + 0.78 + 0.53), IV — 3.54 long (0.98 + 0.88 + 0.28 + 0.90 + 0.50). TmI — 0.53. Abdomen 1.70 long, 1.20 wide. Epigynum as in Fig. 5. Body and legs coloration, chaetotaxy as in male.

Oedothorax coronatus n. sp., Figs 6—9, 10—13.

Material: Holotype male (SMF), Nepal, Ilam Distr., Mai Pokhari, 2100—2200 m, forest, 25.—27. III. 1980, leg. J. Martens & A. Ausobsky. — Paratypes: 5 males (SMF), 2 males (ZMMU), same locality, together with holotype, 25.—27. III. 1980, leg. J. Martens &



Figs 6—9: Male carapace of *Oedothorax coronatus* n. sp., 6—7) form a, paratype from Ilam Distr.; 8—9) form b, paratype from Panchthar Distr. — 6 & 8) lateral view; 7 & 9) dorsal view.

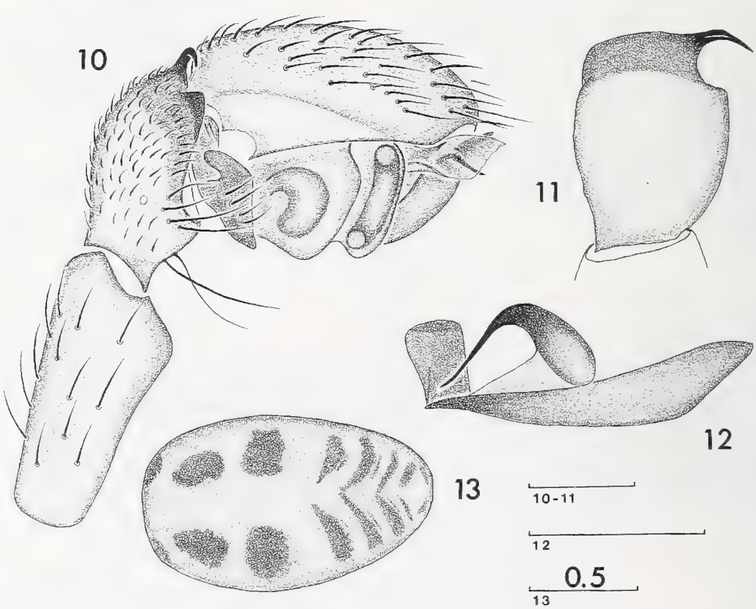
A. Ausobsky; 2 males (SMF), 2 males (ZFMK), Ilam Distr., Mai Pokhari, 2100, forest, 31. III.—1. IV. 1980, leg. J. Martens & A. Ausobsky; 1 male (SMF), Ilam Distr., Gitang Khola, 1900—2100 m, cultivated land, 31. III. 1980, leg. J. Martens & A. Ausobsky; 1 male (SMF), 1 male (ZMMU), Ilam Distr., Mai Pokhari, 2100—2200 m, *Castanopsis* forest remains, 9.—10. IV. 1988, leg. J. Martens & W. Schawaller; 4 males [carapace form b] (SMF), Panchthar Distr., Paniporua, 2300 m, mixed broadleaved forest, 16.—20. IV. 1988, leg. J. Martens & W. Schawaller; 4 males [carapace form b] (SMF), 1 male [carapace form b] (ZMMU), Taplejung Distr., Worebung Pass, degraded broadleaved forest, 2000, 21. IV. 1988, leg. J. Martens & W. Schawaller.

Diagnosis: The new species is characterized by the shape of both male carapace and palpal tibia.

Etymology: The specific name coronatus is a Latin adjective meaning "crowned", referring to the male cephalic structure.

Description: Male (female unknown). Total length 2.48. Carapace 1.18 long, 0.90 wide, medially with a large conical "hump". Cephalic division elevated, with four specific setae. Two different shapes of carapace: carapace form a — Figs 6—7 (specimen from Ilam Distr.), and carapace form b — Figs 8—9 (specimen from Panchthar and Taplejung distr.). No differences whatever in palpal structure regardless of carapace shape. Chelicerae 0.48 long. Legs pale brown. Leg I — 4.46 long (1.25 + 1.10 + 0.30 + 1.13 + 0.68), IV — 4.78 long (1.38 + 1.25 + 0.30 + 1.30 + 0.55). Chaetotaxy: 2.2.1.1. Each metatarsus with a trichobothrium. Tm I — 0.80. Palp as in Figs 10—12. Abdomen 1.38 long, 0.90 wide, dorsal pattern as in Fig. 13.

Taxonomic remarks: The new species is very closely related to *angelus* n. sp., being well distinguished by the shape of the cephalic setae, presence of a carapace "hump", as well as by the shape of the palpal tibia.



Figs 10—13: *Oedothorax coronatus* n. sp., male paratype from Mai Pokhari. — 10) right palp; 11) palpal tibia (dorsal view); 12) embolic division; 13) abdomen (dorsal view).

Oedothorax angelus n. sp., Figs 14—18

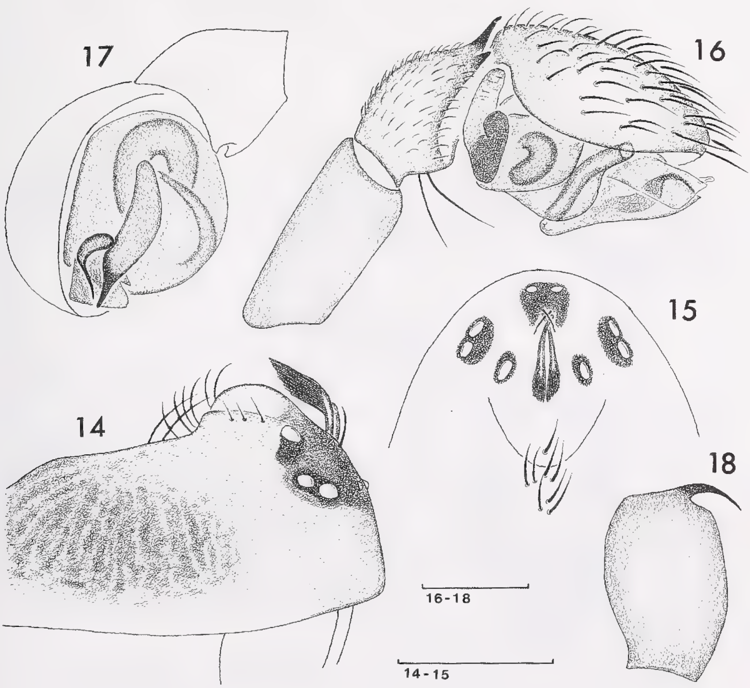
Material: Holotype male (SMF), Nepal, Panchthar Distr., Dhorpar Kharka, *Rhododendron* & *Lithocarpus* forest, 2700 m, 13.—16. IV. 1988, leg. J. Martens & W. Schawaller. — Paratypes: 4 males (SMF), 1 male (ZMMU), same locality, together with holotype, leg. J. Martens & W. Schawaller; 4 males (SMF), 2 males (ZFMK), 1 male (ZMMU), Panchthar Distr., Paniporua, 2300 m, mixed broadleaved forest, 16.—20. IV. 1988, leg. J. Martens & W. Schawaller.

Diagnosis: The new species is characterized by the shape of both male carapace and palpal tibia.

Etymology: The specific name from Latin is translated as an "angel" and refers to the shape of the male cephalic setae looking like the angel wings.

Description: Male (female unknown). Total length 2.00. Carapace 0.95 long, 0.73 wide, cephalic part carrying two large and two small characteristic setae situated in central part of eye area (Figs 14—15). Chelicerae 0.28 long. Legs pale brown. Leg I — 3.29 long (0.88 + 0.25 + 0.90 + 0.78 + 0.48), IV — 3.18 long (0.90 + 0.20 + 0.85 + 0.83 + 0.40). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I — 0.81. Palp (Figs 16—18). Abdomen 1.05 long, 0.68 wide, dorsal pattern close to that of *coronatus* n. sp.

Taxonomic remarks: The new species is close to *coronatus* n. sp. (see above).



Figs 14—18: *Oedothorax angelus* n. sp., male paratype from Dharpar Kharka. — 14—15) carapace (lateral and dorsal views, respectively); 16—17) right palp; 18) palpal tibia (dorsal view).

Oedothorax sexoculorum n. sp., Figs 19—23.

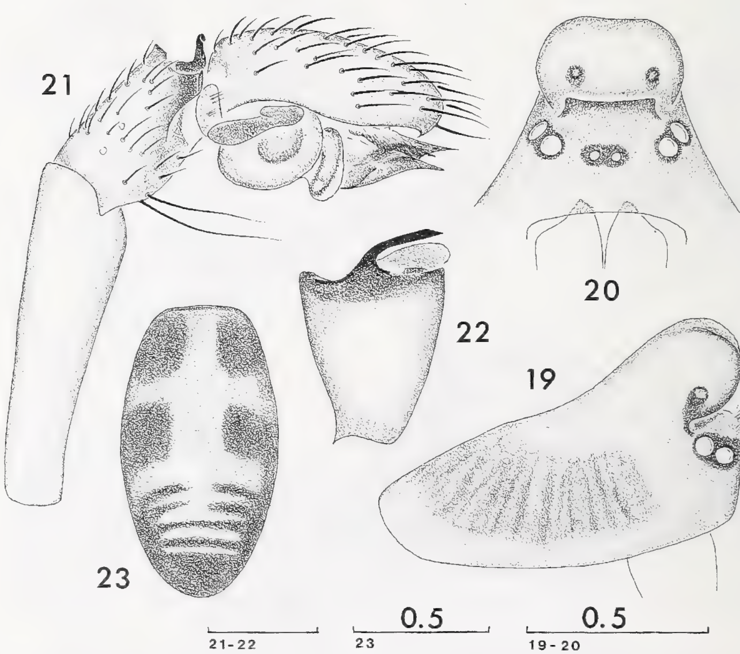
Material: Holotype male (SMF), Nepal, Terhathum Distr., Tinjura Dara, 2450—2850 m, species-rich mixed broadleaved forest, Berlese funnels, 17. IX. 1983, leg. J. Martens & B. Daams.

Diagnosis: The new species is diagnosed by the shape of the male carapace, presence of six operating eyes: PME covered by the cephalic elevation (maybe this is a teratology: one specimen is known only!), elongated and distally pointed suprategular apophysis, elongated parts of the embolic division, as well as by the absence of a scapuliform apophysis on the embolic division (s. Fig. 12).

Etymology: The specific name is a Latin adjective translated as "possessing six eyes".

Description: Male (female unknown). Total length 2.00. Carapace modified (Figs 19—20), 0.98 long, 0.68 wide, pale brown, with a wide dark ring. Posterior median eyes covered by cephalic elevation, thus male with only six operating eyes. Chelicerae 0.40 long. Legs pale brown. Leg I — 2.99 long (0.80 + 0.25 + 0.73 + 0.73 + 0.48), IV — 3.06 long (0.83 + 0.23 + 0.75 + 0.80 + 0.45). Chaetotaxy 2.2.1.1. Tm I — 0.76. Palp as in Figs 21—22. Abdomen 1.08 long, 0.65 wide, dorsal pattern as in Fig. 23.

Taxonomic remarks: There is another Himalayan congener which has six eyes, namely *O. sexoculatus* Wunderlich, 1974, described from Jiri, East Nepal (Wunderlich 1974). However, both species in question are well distinguishable by the shape of the palpal tibia.



Figs 19—23: *Oedothorax sexoculorum* n. sp., male holotype. — 19—20) carapace (lateral and frontal views, respectively); 21) right palp; 22) palpal tibia; 23) abdomen (dorsal view).

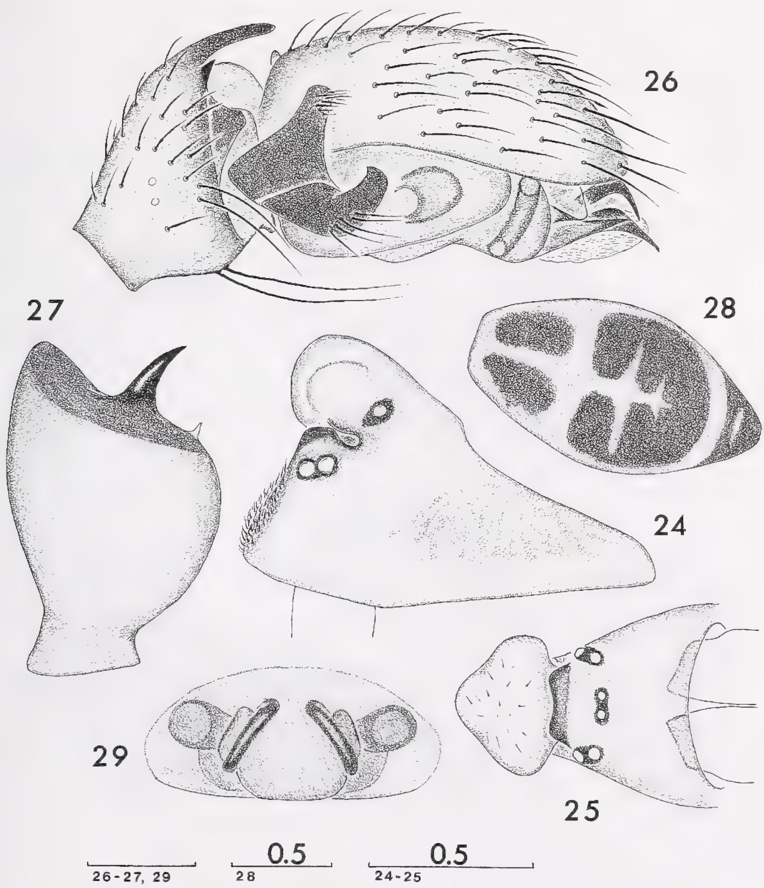
Oedothorax tholusus n. sp., Figs 24—29.

Material: Holotype male (SMF), Nepal, Kaski Distr., above Dhumpus, broadleaved forest, 2100 m, 8.—10. V. 1980, leg. J. Martens & A. Ausobsky. — Paratype: 1 female (SMF), same locality, together with holotype, leg. J. Martens & A. Ausobsky.

Diagnosis: This species is easily distinguished by the shape of the male carapace, small suprategular apophysis, absence of a scapuliform apophysis on the embolic division (s. Fig. 12), as well as by the shape of the palpal tibia.

Etymology: The specific name is a Latin adjective meaning "cupola of temple", this referring to the shape of the male cephalic elevation.

Description: Male. Total length 2.70. Carapace 1.25 long, 0.95 wide, reddish-brown, cephalic elevated as in Figs 24—25. Chelicerae 0.55 long. Legs reddish-brown. Leg I 4.01 long (1.13 + 0.30 + 0.93 + 1.00 + 0.65), IV — 4.18 long (1.15 + 0.30 + 1.05 + 1.10 + 0.58). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I — 0.60. Palp as in Figs 26—27. Abdomen 1.50 long, 0.93 wide, pattern as in Fig. 28.



Figs 24—29: *Oedothorax tholusus* n. sp., male holotype and female paratype. — 24—25) male carapace (lateral and frontal views, respectively); 26) right palp; 27) palpal tibia; 28 male abdomen (dorsal view); 29) epigynum.

Female. Total length 2.18. Carapace 0.75 long, 0.63 wide. Chelicerae 0.30 long. Leg I — 2.06 long (0.60 + 0.23 + 0.48 + 0.45 + 0.30), IV — 2.26 long (0.65 + 0.20 + 0.55 + 0.53 + 0.33). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I — 0.72. Abdomen 1.55 long, 1.08 wide. Epigynum as in Fig. 29. Body and legs coloration, chaetotaxy as in male.

Taxonomic remarks: This species seems to be close to *globipes* Thaler, 1987, from Kashmir, being well distinguishable by the structure of the male palp.

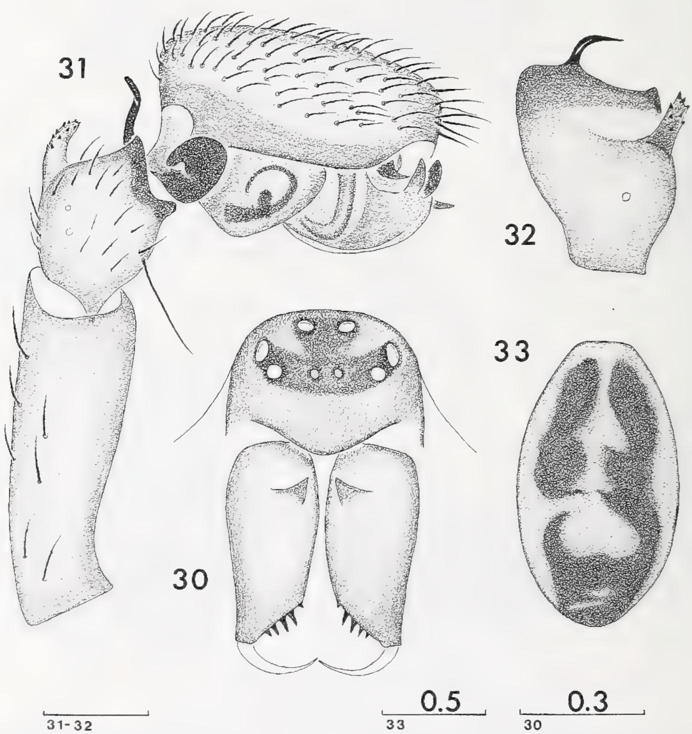
Oedothorax clypeellum n. sp., Figs 30—33.

Material: Holotype male (SMF), Nepal, Kathmandu, Phulchoki Mt., pitfall traps, 2600 m, 21. III.—14. V. 1980, leg. J. Martens & A. Ausobsky.

Diagnosis: This new species is easy recognizable by the shape of both palpal tibia and clypeus, as well as by the presence of a tooth on the frontal surface of the chelicerae.

Etymology: The specific name refers to the characteristic shape of the male clypeus.

Description: Male (female unknown). Total length 2.53. Carapace 1.13 long, 0.85 wide, brown-grey, with a pale margin; cephalic division not elevated, clypeus conical (Fig. 30). Chelicerae 0.48 long, basally with a large conical tooth (Fig. 30). Legs pale brown. Leg I — 3.16 long (0.83 + 0.30 + 0.80 + 0.78 + 0.45), IV — 3.48 long (0.88 + 0.30 + 0.90 + 0.95 + 0.45). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I — 0.88. Palp as in Figs 31—32. Abdomen 1.38 long, 0.90 wide, dorsal pattern as in Fig. 33.



Figs 30—33: *Oedothorax clypeellum* n. sp., male holotype. — 30) carapace (frontal view); 31) right palp; 32) palpal tibia; 33) abdomen (dorsal view).

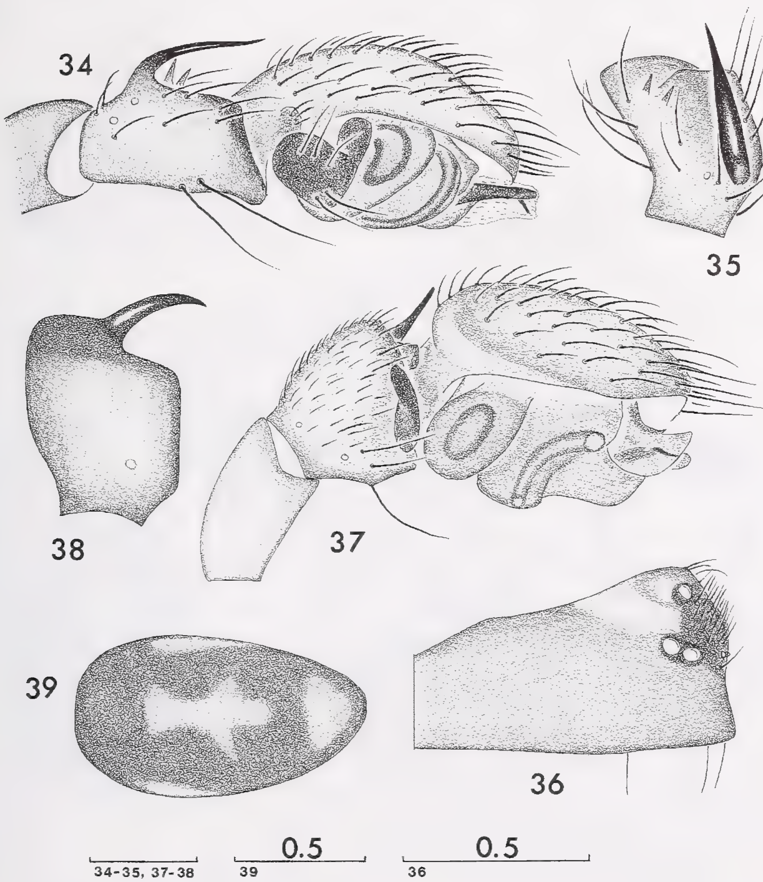
Oedothorax simplicithorax n. sp., Figs 34—35.

Material: Holotype male (SMF), Ilam Distr., Gitang Khola Valley, *Alnus* forest along river, 1750 m, 11.—13. IV. 1988, leg. J. Martens & W. Schawaller. — Paratype: 1 male (SMF), same locality, together with holotype, leg. J. Martens & W. Schawaller.

Diagnosis: The new species is diagnosed by the structure of the palpal tibia, as well as by the small both suprategular apophysis and "embolus".

Etymology: The specific name refers to the unmodified shape of the male carapace.

Description: Male (female unknown). Total length 1.93. Carapace 0.88 long, 0.73 wide, pale brown, unmodified. Chelicerae 0.33 long. Legs pale brown. Leg I — 3.23 long (0.85 + 0.25 + 0.83 + 0.75 + 0.55), IV — 3.41 long (0.95 + 0.28 + 0.85 + 0.83 + 0.50). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I — 0.60. Palp as in Figs 34—35. Abdomen 1.13 long, 0.70 wide, dorsally grey, with a pale median stripe.



Figs 34—39: *Oedothorax simplicithorax* n. sp. (34, 35), male holotype, and *O. modestus* n. sp. (36—39), male holotype. — 34 & 37) right palp; 35 & 38) palpal tibia (dorsal view); 36) carapace (lateral view); 39) abdomen (dorsal view).

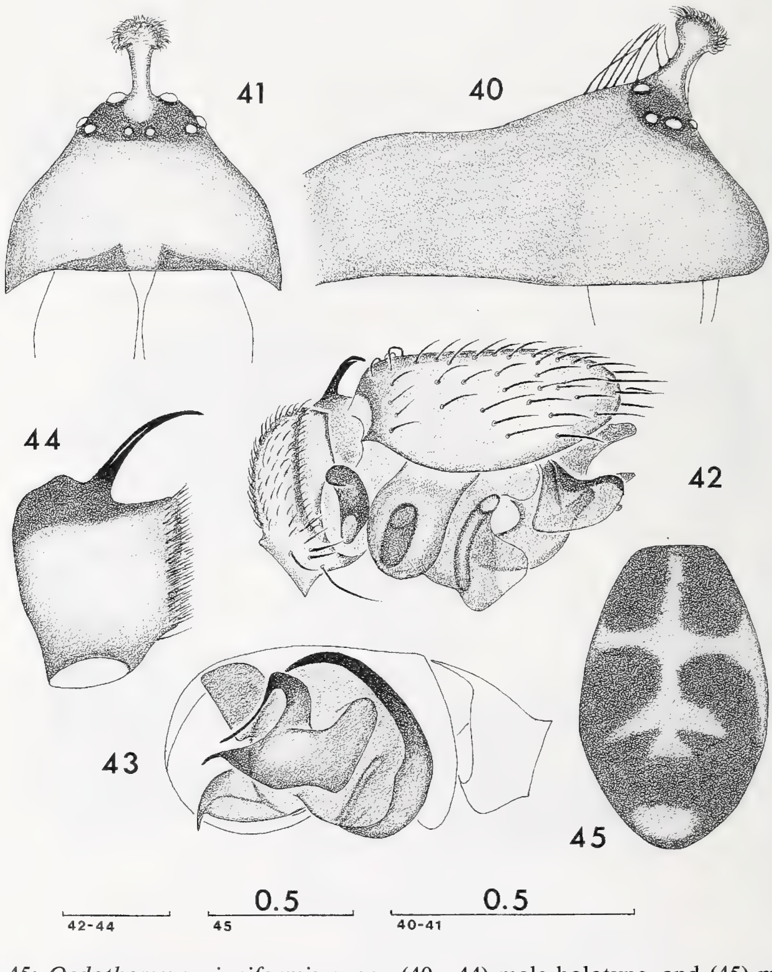
Oedothorax modestus n. sp., Figs 36—39.

Material: Holotype male (SMF), Panchthar Distr., Paniporua, 2300 m, mixed broadleaved forest, 16.—20. IV. 1988, leg. J. Martens & W. Schawaller. — Paratypes: 5 males (SMF), 1 male (ZMMU), same locality, together with holotype leg. J. Martens & W. Schawaller.

Diagnosis: The new species is characterized by the shape of both carapace and palpal tibia.

Etymology: The specific name is a Latin adjective meaning "moderate", "temperate", this referring to the poorly modified male carapace.

Description: Male (female unknown). Total length 2.05. Carapace 1.00 long, 0.75 wide, pale brown with a pale area situated behind cephalic division (Fig. 36). Chelicerae 0.33 long. Legs pale brown. Leg I — 3.78 long (1.00 + 0.30 + 0.93 + 0.90 + 0.65), IV — 3.98 long (1.10 + 0.27 + 0.98 + 1.00 + 0.63). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I — 0.56. Palp as in Figs 37—38. Abdomen 1.15 long, 0.75 wide, dorsal pattern as in Fig. 39.



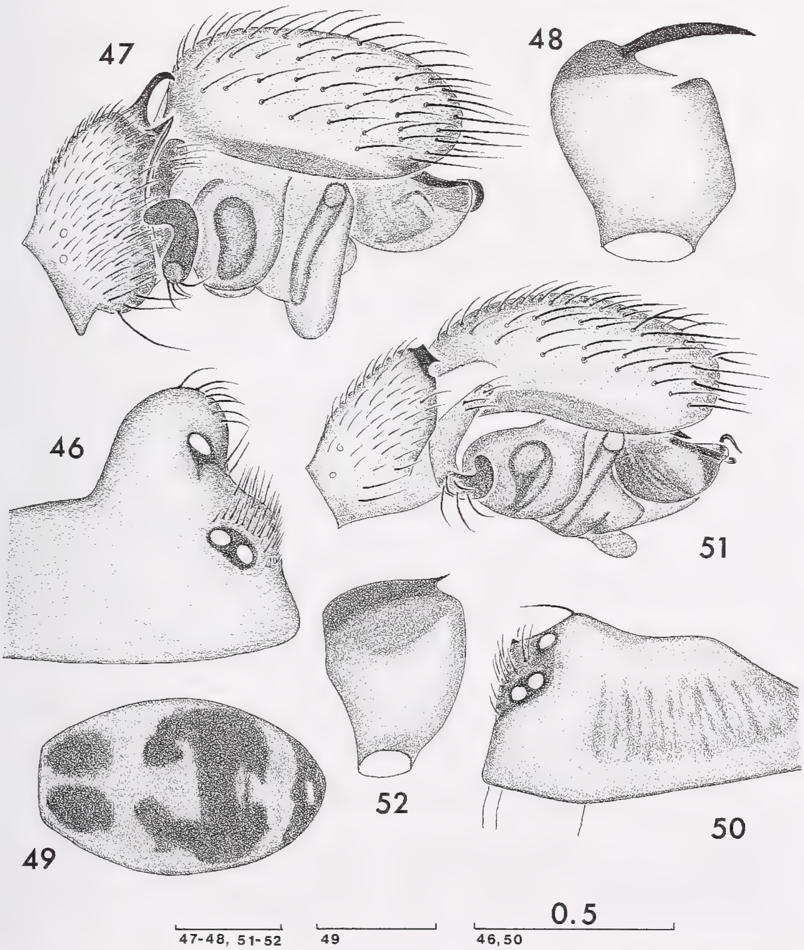
Figs 40—45: *Oedothorax savigniformis* n. sp., (40—44) male holotype, and (45) male paratype. — 40—41) carapace (lateral and frontal views, respectively); 42—43) right palp; 44) palpal tibia (dorsal view); 45) abdomen (dorsal view).

Taxonomic remarks: This species is closely related to *falciferus* n. sp., the structure of the embolic division being almost identical. Both species compared are well distinguishable by the shape of the cephalic elevation and the structure of the palpal tibia.

Oedothorax savigniformis n. sp., Figs 40—45.

Material: Holotype male (SMF), Taplejung Distr., Yamputhin, ascent to pass Deorali, 2600 m, cultivated land, 16. V. 1988, leg. J. Martens & W. Schawaller. — Paratype: male (SMF) Panchthar Distr., Paniporua, 2300 m, mixed broadleaved forest, 16.—20. IV. 1988, leg. J. Martens & W. Schawaller.

Diagnosis: This species is well distinguishable by the shape of the cephalic division.



Figs 46—52: *Oedothorax falciferus* n. sp. (46-49), male holotype, and *O. malearmatus* n. sp. (50—52), male holotype. — 46 & 50) carapace (lateral view); 47 & 51) right palp; 48 & 52) palpal tibia; 49) abdomen (dorsal view).

Etymology: The specific name refers to the male cephalic shape similar to that of *Savignia* species.

Description: Male. Total length 2.05. Carapace 1.05 long, 0.70 wide, modified (Figs 40—41), dirty-grey, with radial stripes, with a partly depigmented cephalic area. Chelicerae 0.33 long. Legs pale brown. Leg I — 3.01 long (0.83 + 0.25 + 0.70 + 0.70 + 0.53), IV — 3.14 long (0.88 + 0.25 + 0.78 + 0.80 + 0.43). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I 0.64. Palp as in Figs 42—44. Abdomen 1.05 long, 0.73 wide, dorsal pattern of paratype as in Fig. 45. Abdomen of holotype dark grey, dorsal pattern absent.

Taxonomic remarks: This species is closely related to both *modestus* n. sp. and *falciferus* n. sp., being well different by the shape of the cephalic part of the carapace.

Oedothorax falciferus n. sp., Figs 46—49.

Material: Holotype male (SMF), Ilam Distr., Worebung Pass, degraded broadleaved forest, 2000 m, 21. IV. 1988, leg. J. Martens & W. Schawaller.

Diagnosis: The new species is diagnosed by the shape of both carapace and palpal tibia, as well as by the relatively large suprategular apophysis.

Etymology: The specific name is a Latin adjective meaning "carrying a sickle", thus referring to the shape of the male palpal tibia.

Description: Male (female unknown). Total length 2.33. Carapace 1.13 long, 0.85 wide, pale brown, cephalic part with an elevation (Fig. 46). Chelicerae 0.48 long. Legs pale brown. Leg I — 4.17 long (1.13 + 0.30 + 1.01 + 1.00 + 0.73), IV — 4.36 long (1.20 + 0.25 + 1.13 + 1.13 + 0.65). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I — 0.60. Palp as in Figs 47—48. Abdomen 1.20 long, 0.88 wide, dorsal pattern as in Fig. 49.

Taxonomic remarks: This species is closely related to *modestus* n. sp. (see above).

Oedothorax malearmatus n. sp., Figs 50—52.

Material: Holotype male (SMF), Panchthar Distr., Paniporua, 2300 m, mixed broadleaved forest, 16.—20. IV. 1988, leg. J. Martens & W. Schawaller.

Diagnosis: The new species is characterized by the shape of both carapace and palpal tibia.

Etymology: The specific name consists of two Latin words: malus meaning "poorly, badly", and armatus "armed", referring the structure of the palpal tibia.

Description: Male (female unknown). Total length 2.05. Carapace with a small cephalic elevation behind PME and with a very small ridge-shaped tubercle situated between PME and AME (Fig. 50), 0.83 long, 0.65 wide, pale brown, with a wide dark ring. Chelicerae 0.35 long. Legs pale brown. Leg I — 3.41 long (0.85 + 0.28 + 0.80 + 0.83 + 0.65), IV — 3.51 long (0.95 + 0.25 + 0.90 + 0.88 + 0.53). Chaetotaxy 2.2.1.1. Each metatarsus with a trichobothrium. Tm I — 0.44. Palp as in Figs 51—52. Abdomen 1.13 long, 0.73 wide, dark grey, dorsally with a pale median stripe at fore half of abdomen.

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Zusammenfassung

In diesem Beitrag werden elf neue Arten der Spinnengattung *Oedothorax* Bertkau, 1883, aus dem Nepal-Himalaya beschrieben.

Fig. 53: Collecting sites of *Odothorax* species in Nepal (Martens collection, species of both papers, Wunderlich [1974] and the present study). — 1) Lete (*O. dismodicoides* Wunderlich); 2) lake Titi (*O. dismodicoides, O. lineatus* Wunderlich); 3) Gorapani Pass and between Gorapani Pass and Ulleri (*O. dismodicoides, O. lineatus*); 4) above Dhumpus (*O. tholusus* n. sp.); 5) between Ramche and Dhunche (*O. hirsutus* Wunderlich); 6) Godawari and Phulchoki Mt. (*O. unicolor* Wunderlich, *O. assuetus* n. sp., *O. clypeellum* n. sp.); 7) Jiri and Mt. Chordung (*O. annulatus* Wunderlich, *O. asocialis* Wunderlich, *O. sexoculatus* Wunderlich, *O. lucidus* Wunderlich); 8) Tinjura Dara (*O. sexoculorum* n. sp.); 9) between Yamputhin and Pass Deorali (*O. savigniformis* n. sp.); 10) Worebung (*O. coronatus* n. sp., *O. falciferus* n. sp.); 11) Paniporua (*O. coronatus* n. sp., *O. angelus* n. sp., *O. melearmatus* n. sp., *O. modestus* n. sp., *O. savigniformis* n. sp.); 12) Dhorpar Kharka (*O. angelus* n. sp.); 13) Gitang Khola (*O. coronatus* n. sp., *O. simplicithorax* n. sp.); 14) Mai Pokhari (*O. coronatus* n. sp.). — According to species: *O. angelus*: 11, 12; *O. annulatus*: 7; *O. asocialis*: 7; *O. assuetus*: 6; *O. clypeellum*: 6; *O. coronatus*: 10, 11, 13, 14; *O. dismodicoides*: 1, 2, 3; *O. falciferus*: 10; *O. hirsutus*: 5; *O. lineatus*: 2; *O. lucidus*: 7; *O. malearmatus*: 11; *O. modestus*: 11; *O. savigniformis*: 9, 11; *O. sexoculatus*: 7; *O. sexoculorum*: 8; *O. simplicithorax*: 13; *O. tholusus*: 4; *O. unicolor*: 6.

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